OCS EIS/EA
MMS 87-0069

Alaska Outer Continental Shelf

Beaufort Sea Sale 97

Final Environmental Impact Statement

Volume II

U.S. Department of the Interior
MMS Minerals Management Service
Alaska OCS Region

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MMS 87-0069

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June 1987

U.S. Department of the Interior
Minerals Management Service
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Proposed Beaufort Sea Lease Sale 97
Final Environmental Impact Statement
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VOLUME II

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REVIEW AND ANALYSIS OF COMMENTS RECEIVED

V

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V. REVIEW AND ANALYSIS OF COMMENTS RECEIVED

A. Introduction

During the DEIS comment period, written comments and oral testimonies were provided by various governmental agencies, petroleum companies and related associations, environmental organizations, and individuals. A total of 22 letters of comment were received; 6 were from Federal agencies, 1 from the State of Alaska, 2 from local governments, 9 from petroleum companies and 2 from related associations, 1 letter signed by 9 environmental organizations and 1 from a private development organization. Public hearings were held in Anchorage and the North Slope Borough communities of Barrow, Kaktovik, Nuiqsut, and Wainwright. A total of 46 testimonies were presented at these hearings: 11 in Anchorage, 12 in Barrow, 6 in Kaktovik, 7 in Nuiqsut, and 10 in Wainwright. Testimony was received from 18 individuals, 14 from local government agencies, 1 from the Yukon Territory government, 3 from the AEWC, 5 from environmental organizations, and 5 from petroleum companies and related associations.

Most of the comments on the DEIS addressed concerns regarding (1) deferral alternatives, (2) mitigating measures, (3) subsistence (regional and community effects), (4) effects on the biological resources of the sale and adjacent areas, (5) oil spills and oil-spill-cleanup technology, (6) adequacy of environmental information, and (7) effects an air and water quality.

All of the written and oral comments on the Sale 97 DEIS were reviewed, and responses were prepared for approximately 475 comments. Where comments warranted changes or presented new, substantive information, the text of the EIS was revised accordingly; reference to the revised sections is made in the responses to the specific comments.

The following substantial changes were made to the text:

(1) the leasing history section was revised to reflect the current status of Federal and State of Alaska oil and gas leases in the Beaufort Sea;

(2) the exploration scenario was revised to reflect a reduction in the number of exploration wells expected to be drilled as a result of Sale 97;

(3) the development and production scenario was revised to allow for a longer period of time, about 12 to 13 years, between the lease sale and the start of production;

(4) information on the fishes of the Beaufort Sea that became available after publication of the DEIS was added to the description of fishes in Section III.B.2;

(5) additional information was added to the description of community subsistence patterns in Section III.C.3.b;

(6) the description of the water quality, Section III.D.5, was expanded;

(7) additional information on the potential effects of petroleum exploitation on subsistence-harvest patterns was added to Section IV.B.9.a; and

(8) the effects of oil spills on water quality were revised.

B. Letters, Comments, and Responses

The following section presents a reproduction of all letters received during the DEIS comment period. Specific comments in each letter are bracketed and numbered. The MMS responses to the specific comments follow each letter.

Letter Number	Commenter
	Federal Agencies
	Executive Branch--Departments
	Department of the Interior
1	Bureau of Indian Affairs
2	Fish and Wildlife Service
3	Geological Survey
	Department of State
4	Bureau of Oceans and International Environmental and Scientific Affairs
	Independent Establishments
5	Environmental Protection Agency
	Boards, Committees, and Commissions
6	Marine Mammal Commission
	State and Local Governments
	State of Alaska
7	Office of the Governor
8	North Slope Borough
9	City of Nuiqsut
	Petroleum Companies and Related Associations
10	Alaska Oil and Gas Association
11	Amoco Production Company
12	ARCO Oil and Gas Company
13	Chevron U.S.A. Inc.
14	Exxon Company, U.S.A.
15	Marathon Oil Company
16	National Ocean Industries Association (No responses required)
17	Shell Western E & P Inc.
18	Standard Alaska Production Company
19	Texaco USA
20	Union Oil Company of California

Environmental Groups

21 Greenpeace U.S.A.

Other Signatories

Alaska Center for the Environment
Alaska Friends of the Earth
Alaska Wildlife Alliance
American Wildlife Alliance
Northern Alaska Environmental Center
Sierra Club
The Wilderness Society
Trustees for Alaska

22 Private Development Organization

Resource Development Council for Alaska, Inc.
(No responses required)

UNITED STATES GOVERNMENT

memorandum 1.

BUREAU OF INDIAN AFFAIRS
JUNEAU AREA OFFICE

DATE: December 10, 1986

REPLY TO ATTN OF: Area Director, Juneau Area

SUBJECT: Draft Environmental Impact Statement for the Proposed 1988 Outer Continental Shelf Sale 97 in the Beaufort Sea

TO: Regional Director, Minerals Management Service, Alaska Region

The Bureau of Indian Affairs has reviewed the DEIS for sale 97 and would like to offer the following comments.

The comprehensive document provides a vast amount of detailed information, so much in fact that organization could be improved to enhance tracking the issues through the range of alternatives. We suggest that certain key elements of the DEIS be given bold type, either moved to the center of the page or extreme left-hand margin and given adequate spacing to highlight these. For example, the heading on Table II-C-1, page IV-B-26 "3. Effects on Marine and Coastal Birds" is hidden between (5) Conclusions and a. Effects of the Proposal. 1-1

The same is true of marine mammals, etc., on IV-B-34 and caribou on IV-B-36. Since these resources are of very high interest and were associated with the primary issue, they should be highlighted better within the organization of the document.

It may be helpful to include the table of contents for each section at the start of each section to save the reader of constantly having to refer to this in the first 10 pages.

In the summary, it should be stated the proposed lease sale would add another oil and gas sale to a list of over 20 oil and gas development projects now planned or ongoing on the North Slope. It should also be stated how long lease sale 97 would be in effect, i.e., 1988 - 1998 or whatever is correct. 1-2

The tables and maps were very professional and helpful in understanding the proposal Table IV-A-7 and graphics 3, 4, 5, and 6 are among the finest examples.

In considering the alternatives evaluated and the proposal for alternative I, the Bureau recommends that an alternative combining alternatives IV and V with the Barrow and Kaktovik deferral areas be considered.

This recommendation by the Bureau is based on: 1-3

(A) The probability of oil spills.

(B) Potential effects to subsistence resources and uses that could be avoided in deferral areas, especially around Barrow and Kaktovik.

(C) Subsistence harvest patterns are more apt to be affected in implementation of the proposed alternative.

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REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Regional Director
Minerals Management Service
Page Two
December 10, 1986

(D) Cancellation, delay and deferral options can reduce environmental effects; however, the preferred alternative excludes all these options.

(E) Potential for permanent disruption of harvest of bowhead whales resulting in irreversible or irretrievable loss to Inupiat cultural and social values is greatest in the proposed alternative (see page IV-K-1).

(F) The Barrow and Kaktovik deferrals were supported by nearly all pertinent parties during scoping.

(G) 67% of all public testimony was subsistence related (see Table III-C-3).

The conclusions for Effects on Subsistence Harvest Patterns (page IV-E-8) and (IV-F-7) are based on a region-wide analysis and do not acknowledge potential severe localized effects on subsistence uses. This conclusion is contradictory to the information given on IV-L-9 where it is stated there may be a significant restriction of subsistence uses for the communities. For this reason, we do not concur with Table IV-L-5. 1-4

The Bureau recognizes the magnitude and difficulty in producing such a comprehensive document and commends Minerals Management Service for the information presented.

Thank you for the opportunity to evaluate and comment on this document.

Steven R. Price
for Jake Lestenkof

GSA JUNEAU 0188

Response 1-1

The format used in this EIS is the same standardized format used in past Alaska OCS Region EIS's. To assist the reader, an inclusive table of contents (TOC) has been included at the beginning of each major section; and, because of the variety of information presented in the EIS, the document has been divided into many subsections, as noted in each section's TOC.

Response 1-2

The suggested additions to the summary have been considered but are not deemed necessary because the information is already summarized in Tables IV-A-7 and II-A-1.

Response 1-3

The Secretary of the Interior has the option of deferring from the Sale 97 proposal area any or all of the deferral areas analyzed in the FEIS or areas proposed after consultation with the Governor of Alaska, pursuant to Section 19 the OCSLA, as amended.

Response 1-4

Effects on subsistence local harvests are of the utmost importance and, wherever possible, this analysis focuses on local effects. For example, this EIS finds that a MAJOR subsistence effect is expected at Wainwright. This finding is based primarily on the possible effects to local subsistence harvests of a pipeline landfall at Point Belcher. The Point Belcher area is only a small part of Wainwright's entire subsistence-use area, but it is an important part of it. MMS acknowledges the concern regarding potential severe localized effects on subsistence uses. It is not too hard to focus on local subsistence effects when the causal agent can be placed in a specific locale. However, such a focus is more difficult when, for example, one considers noise and traffic disturbances associated with exploration units; since this EIS is for a lease sale, exploration plans have not yet been developed. In the case of noise, as in the case of oil spills, predictive tools such as the scenario and the OSRA analysis are used to make the discussion of subsistence effects as locally specific as possible.

A summary of the potential effects that petroleum exploitation might have on the subsistence-harvest patterns of Barrow-Atqasuk, Kaktovik, Nuiqsut, and Wainwright has been added to the conclusions for each of the deferral alternatives: Sections IV.E.9, F.9, and G.9. The addition of the community-specific effects acknowledges the potential effects petroleum exploration and development and production might have on local subsistence uses. Equal consideration is given to all communities in the analysis of subsistence-harvest patterns. Sections IV.B.9(2) and (3) have been amended to include more discussion of local effects on subsistence uses in each community.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

IN REPLY REFER TO:

FAIRBANKS FISH AND WILDLIFE ENHANCEMENT OFFICE
ECOLOGICAL SERVICES/ENDANGERED SPECIES BRANCH
Room 222, Federal Building, Box 20
101 12th Avenue
Fairbanks, Alaska 99701-6267
January 5, 1987

Regional Director, Alaska OCS Region
Minerals Management Service
Attention: Dick Roberts
949 East 36th Avenue, Room 110
Anchorage, Alaska 99508-4302

Re: Beaufort Sea Sale 97 DEIS

Dear Mr. Roberts:

We have reviewed the draft Environmental Impact Statement (DEIS) for the Beaufort Sea Lease Sale 97, proposed for January 1988. In general, we found the information presented to be comprehensive, well prepared, and thorough. However, we noted a few significant deficiencies, which are outlined in the following comments.

A major problem with the Sale 97 DEIS is the size of the geographical area covered in one assessment. The result is that the significance of potential severe environmental impacts on a local level is diluted by being considered in the context of broad regional evaluations. One way this problem surfaces is shown in the summary of effects for the proposal and deferral alternatives (Table S-1). This summary shows little significant difference in expected impacts between the various deferral alternatives and the proposal alternative (in fact the effects of the Kaktovik deferral are shown as being identical to the proposal), even though the deferral areas were clearly selected to offer protection to certain biological and subsistence resources. This causes some doubt as to whether the method and criteria used for assessing degree of impact are adequate, or whether a sufficient range of alternatives was examined. 2-1

We are very concerned about the predicted MAJOR cumulative impacts to fish in all alternatives, MODERATE impacts to marine and coastal birds in all alternatives, MODERATE cumulative impacts to Bowhead and Gray whales in all alternatives, MODERATE cumulative impacts to caribou in all alternatives, MAJOR cumulative impacts to North Slope sociocultural systems and subsistence in all alternatives, and MODERATE cumulative impacts to water quality in all alternatives.

Since Alternative II (no sale) has been omitted from Table S-1, there is no indication of whether the cumulative effects, which appear to be identical for all alternatives, would also be the same under the "no sale" alternative. For example, are cumulative effects on fish expected to be major, regardless of whether this sale is held? 2-2

In the "Description of the Affected Environment", we are particularly concerned by the very minimal attention to marine and coastal birds. The discussion is superficial and overly generalized, with over 150 species and thousands of individuals included in generic statements about "birds". The only species mentioned by name are in paragraph 1 on p. III-23. The four species listed here could be considered the most common in marine habitats, except that red-necked phalaropes are more common than red phalaropes in the eastern Beaufort area. However, it should be emphasized that many additional species that are more common in coastal wetlands could be potentially affected by this lease sale. At least the more common and the more sensitive of these other species should be addressed specifically in the discussion; the reviewer should be informed of the more common species (of ducks, geese, and swans) which are being referred to by the general statements about "waterfowl", and the more common species (of sandpipers, plovers, and phalaropes) which are being referred to by the general statements about "shorebirds". Some important species groups, such as loons and passerines, are totally absent from this discussion. The incorporation by reference of the information in the Sale 87 FEIS does not greatly improve the discussion, since that information is outdated and also extremely generalized. 2-3

It would be appropriate to identify unique species having limited localized breeding distributions, such as the snow goose colony on Howe Island and the yellow-billed loon nesting population in the Colville delta. The importance of the Teshekpuk Lake area to molting brant and other waterfowl is also worthy of attention. 2-4

The oil spill risk analysis indicates that the chance for an oil spill of 1,000 bbl or greater to occcur and contact land within 10 days is almost a certainty (77% during open water season and 90% during winter; Table IV-A-5). Yet the potential effects of oil spills on marine and coastal birds are judged to be only MODERATE, because "the death of several thousand oldsquaw... or other abundant species would not have major regional effects on regional populations of those species, because natural recruitment within abundant species populations such as oldsquaw would probably replace such losses in one or two generations"(p. IV-B-28 first para.). We believe the emphasis on oldsquaw as a basis to assess severity of oil spill impacts to be inappropriate. While this species is by far the most abundant marine bird species in the Beaufort Sea and is widely distributed, conclusions drawn about oil spill effects on oldsquaw are not necessarily applicable to other species, some of which have much more limited populations and distributions, or more critical or narrow habitat requirements that would render them more vulnerable to oil spill effects. 2-5

Although "bird species with low regional populations... are not likely to suffer high mortality due to an oil spill in the Beaufort Sea" (p. IV-B-31), the fact that fewer birds would be killed would not necessarily mean that the impact would be insignificant. For example, the Howe Island snow goose colony consists of only 40-50 nesting pairs; however, loss of these birds would eliminate the only nesting colony in the U.S. Likewise, an oil spill contacting a single barrier island (Cross, Pole, Egg, or Thetis) could eliminate 20-30% of the season's production of common eiders for the region. Also, an oil spill contacting a shoreline when birds are concentrated there during fall migration has the potential for affecting much more than a localized population of birds, since the entire arctic population of some species may pass through an area within a period of a few days or weeks. For these reasons, we believe that there is potential for MAJOR impact to some species of birds from the Sale 97 lease offering. 2-6

Another major deficiency in the Sale 97 DEIS is in the treatment of onshore impacts. Figure IV-1 shows the hypothetical offshore transportation routes used in the effects assessment, but we can find no figure illustrating the proposed onshore transportation routes. It would be appropriate to include such a figure in the EIS. 2-7 While we find the treatment of potential offshore effects of development of this lease sale to be fairly thorough, the discussions of onshore effects appear somewhat incomplete. For example, the potential effects of a network of pipelines and roads running east-west across the entire North Slope coastal plain on caribou herds could certainly be more than MINOR, since portions of the migration routes of all four major arctic herds would be affected. Conclusions drawn from studies of the Trans-Alaska Pipeline (TAP) and Prudhoe Bay may not be applicable to other areas and other herds on the North Slope. Likewise, depending on the routing of these roads and pipelines, the direct and indirect effects on migratory birds and fish and their habitats could be significant. We also wonder if it is realistic to assume that such a road network would remain permanently closed to public access. 2-8

The assumption that the infrastructure at Prudhoe Bay will be used to support major construction and operation activities for the development, production, and transportation of crude oil across the entire North Slope seems very speculative and even somewhat unrealistic. The impacts associated with support camps and gravel sources necessary for the construction of several hundred kilometers of onshore pipeline and associated roads and other support facilities do not appear to be addressed in the DEIS. 2-9

The Sale 97 DEIS does not address potential impacts on the Arctic National Wildlife Refuge; the issue is avoided by showing undersea pipelines from the eastern sale area coming ashore at Bullen Point. However, we can assume that if the ANWR coastal plain is opened for oil and gas development, any offshore development would logically tie into the onshore infrastructure. This probability, and the potential cumulative environmental effects, should be fully addressed in the Sale 97 EIS. 2-10

We are pleased to see that MMS has acknowledged that the "obvious transportation scheme" includes transportation by offshore subsea pipelines (p. IV-A-3, para. 3); however, before this assumption is used in the effects assessment there should be some assurance of industry willingness to use subsea pipelines rather than solid-fill causeways. To date, industry has shown considerably greater interest in construction of causeways than subsea pipelines. Given the major effects of causeways on the nearshore physical regime and fish migration, as summarized on p. IV-B-24, it would seem appropriate for MMS to enforce their preference for subsea pipelines by including a statement in Stipulation No. 5 (p. II-19) prohibiting the construction of causeways and requiring the use of subsea pipelines for any offshore development resulting from this lease sale. 2-11

In conclusion, we suggest that the Sale 97 EIS should include an alternative which would incorporate all three of the proposed deferral areas, and that this should be the preferred alternative. We believe the proposed deferrals would significantly reduce the major potential impacts associated with this lease sale offering, particularly impacts to whale migration and feeding areas, impacts to the seabird feeding area near Barrow, and impacts on subsistence activities and communities. These deferrals would also greatly reduce the potential onshore impacts by reducing the potential road/pipeline network from 550 km traversing the entire arctic coastal plain, to about 70 km. The Kaktovik deferral would also minimize the vulnerability of the ANWR shorelines (and associated fish and wildlife species) to the risk from the predicted oil spills from offshore wells and subsea pipelines. 2-12

The Chukchi Sea deferral should more appropriately be addressed in a separate lease sale and EIS. The Sale 97 DEIS focuses heavily on the resources and impacts in the Beaufort Sea area, and does not adequately address the significant differences of the Chukchi area. Also, the potential effects of the major onshore construction activity associated with the pipeline that would be required for development of the Chukchi area is not adequately addressed in this DEIS. 2-13

We have the following additional specific comments:

p. II-20: ITL No. 1
It should be noted that North Slope weather frequently prevents total compliance with flight altitude limitations suggested in this ITL due to over-riding safety considerations. Thus it is unlikely that the level of aircraft disturbance would be reduced to NEGLIGIBLE by this ITL. 2-14

p. II-22: ITL No. 2
We suggest that the Colville River delta be included in the list of areas of special biological sensitivity, because of its importance to nesting and staging waterfowl, to anadromous fish, and to subsistence uses. Also, we would suggest including Cross, Pole, 2-15

Egg, and Thetis Islands, as these four islands support 70% of the common eiders nesting on barrier islands between the Colville and Canning Rivers (USFWS data).

Additional ITL's
We suggest that it would be appropriate to inform potential lessees of the land status of the Arctic National Wildlife Refuge which is adjacent to part of this lease sale area. A portion of the ANWR coastal plain (west of the Aichilik River) is currently designated as Wilderness. There is the potential that the remainder of the ANWR coastal plain could be designated as Wilderness, depending on the outcome of the decision by Congress on the 1002 area. If so, lessees should be aware that such designation would preclude any construction of onshore facilities in this area to support offshore development. 2-16

There is also potential that the 1002 area will be opened to oil and gas leasing by Congressional action. In this case, lessees should be aware that onshore support facilities would be subject to stipulations developed in conjunction with the 1002 actions. (See pp. 145-147 of the draft ANWR Coastal Plain Resource Assessment, report to Congress (USDI 1986) for proposed stipulations for the 1002 area.)

p.III-14
Locations of benthic macrophyte communities other than the Stefansson Sound Boulder Patch are not identified. The extreme scarcity as well as the high productivity of benthic macrophyte communities in the Beaufort Sea warrants their thorough investigation, delineation, and protection, even though none may be as extensive as the Boulder Patch of Stefansson Sound. 2-17

p. III-23: para. 3, sentence 2; para. 5, last sentence:
The Canning River delta should be included in these lists of important bird nesting and fall concentration areas. 2-18

Graphic 3
It is unclear why tundra swan concentration areas are only shown for the Arctic National Wildlife Refuge. The highest nesting densities of tundra swans on the North Slope are found in the Colville River delta. Relatively high densities of nesting swans are also found in the Prudhoe Bay area (between Colville and Sag Rivers), the Smith Bay area, and around Dease Inlet. Also, because of the high nesting densities of many bird species on the Canning River delta, it should probably be shown as a "high sensitivity area". 2-19

Graphic 4
More recent data on polar bear denning habitat for the North Slope should be available that could be included on this map. (See attached map of polar bear denning areas on ANWR.) 2-20

Graphic 5
Since most of the "summer movement" arrows point away from the coast, this map does not indicate the importance of coastal areas as insect relief habitat for caribou. It is stated on p. III-31, para. 3, that "during the post-calving period in July and August, caribou generally attain their highest degree of aggregation ... cow/calf groups are most sensitive to human disturbance during this period." Thus it would seem appropriate to show these post-calving aggregation areas, in addition to the calving areas, on graphic 5. 2-21

Graphic 6
This map is inaccurate, and should be updated to reflect the current State of Alaska 5-year plan for proposed lease sales. Specifically, Beaufort Sea (52) is now scheduled for 1989; North Slope Foothills (57) is now scheduled for 1990; and Icy Cape (53), Offshore Icy Cape (58), Point Franklin (60), and White Hills (61) have been eliminated from the current 5-year leasing schedule. Also, the Prudhoe Bay Uplands (51) lease area is not as shown on the map, as only the northern half is currently being offered. 2-22

p. IV-B-2 and B-3
The discussion of potential oil spill effects on macrophytes focuses on the probability of an oil spill contacting the Boulder Patch of Stefansson Sound, and does not consider the probability of contacting other known kelp communities. 2-23

p.IV-B-32: para. 5
The loss of "thousands or tens of thousands of birds... as a result of oil spills over the life of these projects" might not result in a significant decline in the oldsquaw population, but could result in MAJOR impacts to other species. Other species besides those mentioned which would be likely to suffer high mortality rates from an oil spill would be: Pacific, red-throated, and yellow-billed loons (which feed in coastal lagoons throughout the breeding season); glaucous gulls and arctic terns (which nest on barrier islands); Ross' gull (during fall migration at Pt. Barrow); red and red-necked phalaropes, dunlin, and sanderling (most common shorebird migrants on barrier islands in August and September); and other species of eiders and scoters (which are included in the term "sea ducks"). 2-24

p. IV-B-65: para. 3
We believe that considerably more than 10 km of pipeline would be needed to connect Bullen Point to TAP, since the distance is at least 50 km. Please clarify. 2-25

p. IV-B-65 and 66
Please clarify the discrepancy between the total amounts of onshore pipeline indicated in these paragraphs, with the total given in Table II-A-1: 2-26

a)Bullen Pt. to TAP: 10 km (correct to 50 km, see above)
b)Oliktok Pt. to TAP: 20 km
c)Pt. Belcher to TAP: 480 km (Pt. Belcher to NPRA: 140km)

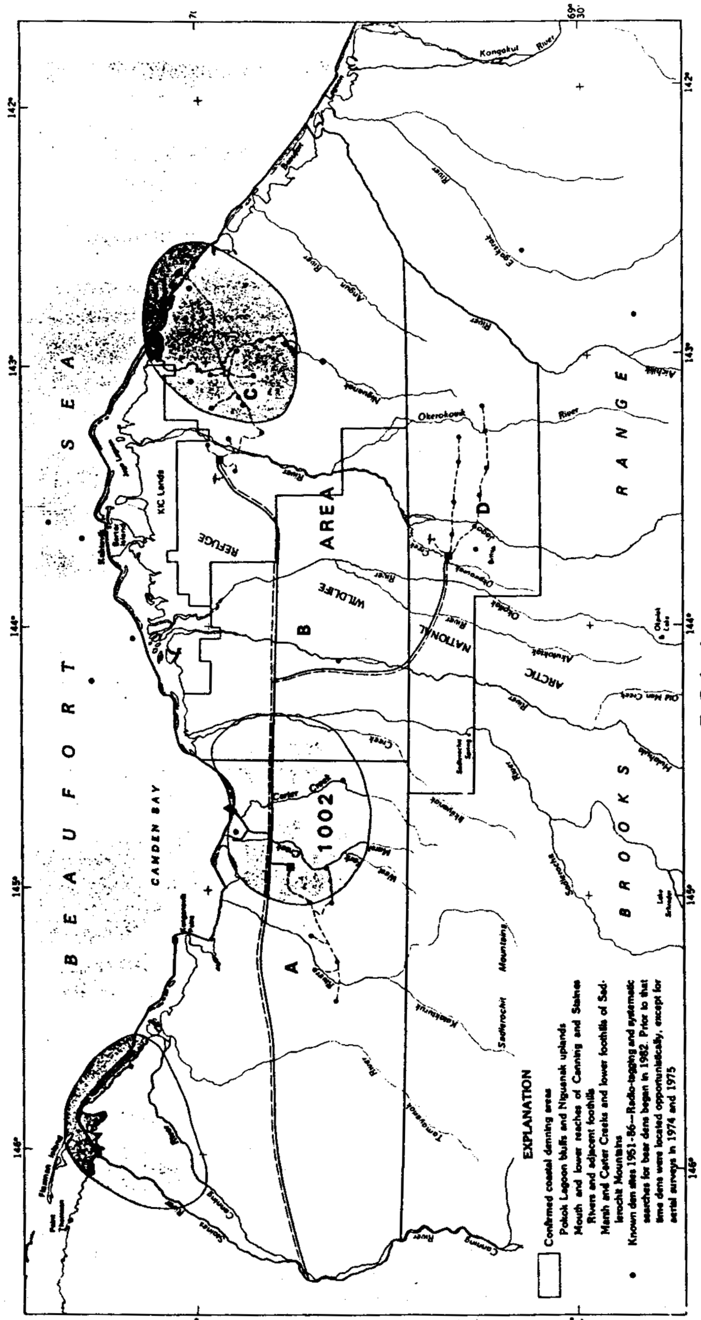
Total: 550 km
Total given in Table II-A-1: 160 km for Sale 97 (360 km total for Beaufort Sea).

We appreciate the opportunity to comment on the DEIS for the OCS Sale 97 Lease Sale. If you have any questions regarding these comments, please contact Kate Moitoret at 456-0209.

Sincerely,

Tony Booth
Acting Field Supervisor

cc: Chief, ES, FWS, Washington, D.C.
BEC, FWS, Washington, D.C.
Glenn Elison, Refuge Manager, ANWR, Fairbanks,
Ann Rappoport, USFWS, Anchorage
Ron Morris, NMFS, Anchorage
Rich Sumner, EPA, Anchorage
Jim Siedl, MMS, Anchorage
John Warren, DO&G, Anchorage
Warren Matumeak, NSB, Barrow
Jan Sorice, DGC, Fairbanks
Al Ott, ADF&G, Fairbanks
Paul Bateman, ADEC, Fairbanks
Larry Dietrick, N. Slope Dist. Office, ADEC, Fairbanks
Rick Smith, ADLWM, Fairbanks



E. Polar bear

Response 2-1

The FEIS for Sale 97 has been written to address the possible environmental effects from oil exploration and development and production that may occur anywhere in an area covering approximately 21.2 million acres. Because the location of potential petroleum reservoirs and hence the exploration and development and production facilities and activities are unknown, the effects of the proposed lease sale are evaluated for an area selected by the Secretary of the Interior for further study and environmental analysis, Section I.A.4, and for adjacent areas that might be affected by activities associated with the proposed sale. Also, the effects at specific locations are more appropriately addressed when exploration and development and production plans are submitted in accordance with 30 CFR 250.34 for public comment and MMS approval.

A previous FEIS, for Sale 87, analyzed the potential effects on the biological resources, sociocultural systems, and physical regimes from possible petroleum-exploitation activities in a proposed lease-sale area covering approximately 17.2 million acres; Sale 87 was the third OCS oil and gas lease sale in the Beaufort Sea (formerly Diapir Field) Planning Area.

The specific effects on the biological resources, sociocultural systems, and physical regimes of removing each of the deferral areas from the Sale 97 area are not discounted; they are analyzed in Sections IV.E, F, and G. Although some of the effects of the lease sale may be reduced in those areas within and adjacent to the deferral areas, the regional effects may not change because (1) the differences in the petroleum-resource estimates for each of the alternatives are not great enough to change the hypothetical scenario conditions and (2) the definitions assumed in effects assessment, Table S-2, are rather general.

The analyses of the potential effects for the proposal and for each of the deferral alternatives are based on hypothetical conditions as described in the exploration and development and production scenarios for the proposal, Sections II.A.1 through 4, and for the deferral alternatives, Section II.A.6. These conditions are, in turn, based on the mean-case petroleum-resource estimates for the proposed sale area (Table II-A-1 and Appendix G--Table G-2) and for each deferral alternative (Table II-A-2 and Appendix G--Tables G-5, 6, and 7). Each alternative sale-area configuration is formed by deleting a deferral area from the proposed Sale 97 area.

These deferral areas are selected on the basis of information obtained during the scoping process, Section I.A.5, and not on potential petroleum resources. Estimates of the petroleum resources for each of the deletion alternatives are obtained after the deferral areas have been determined; and, until exploration and delineation wells are drilled, these resource estimates remain very speculative.

If the differences in the petroleum estimates for the proposal and each of the deferral alternatives are not great enough to significantly change the hypothetical scenario conditions, then the overall effects of petroleum exploitation on an entire regional resource, system, or regime are expected to be about the same, at least as interpreted by the definitions assumed for effects

assessment--Table S-2. Tables II-C-1 and S-1 are summaries of the most likely regional effects on the biological resources, sociocultural systems, or physical regimes for the proposal and each of the deferral alternatives.

Response 2-2

Table S-1 is a summary of the effects for those alternatives that provide for some variation in the size of the area offered for leasing and, potentially, in the amount of oil estimated to be present; these are Alternatives I, IV, V, and VI. If there is no lease sale, any environmental effects would be associated with other activities that, as noted in Table IV-A-7, are considered in Section IV.C, No Lease Sale Alternative, and in the cumulative-effects assessment.

Response 2-3

The description of marine and coastal birds in Section III.B.2 discusses and lists those species of birds most common in the sale area whose populations could be affected by the proposed action. Other key sensitive species such as snow geese and Pacific brant that may be affected primarily by other oil-development projects are discussed in the cumulative analysis and were listed in the 87 FEIS, which was summarized and incorporated by reference. Other common and abundant species of seabirds, waterfowl, and shorebirds--including northern (red-necked) phalarope--that occur along the coast of the Sale 97 area are listed and discussed in the Sale 87 FEIS, which was incorporated by reference. Some species groups such as loons and passerines are absent from the Section III.B.2 discussion because these species' populations are very unlikely to be affected by the proposed action. The Sale 87 FEIS description of marine and coastal birds along the coast of the Beaufort Sea and on the Arctic coastal plain is not outdated; the bird species populations described in the Sale 87 EIS and the information on distribution of these species in the planning area has not changed since the Sale 87 FEIS was published.

Response 2-4

The Howe Island snow goose colony represents a minor snow goose colony rather than a unique population; the majority of the snow geese nest on Banks Island and Wrangel Island. Bird colonies including the Howe Island colony have been identified on Graphic 3. Teshekpuk Lake and the Colville Delta were identified in the text as very important nesting habitats for waterfowl. The importance of these two areas to Pacific brant and the yellow-billed loon has been added to the text, Section III.3.

Response 2-5

With reference to Tables IV-A-5 and IV-A-6, the 77-percent and 90-percent probabilities that one or more oil spills would occur and contact land within 10 days are for the cumulative case--they are not for the proposal alone, which has a 23-percent and 32-percent chance of such contact. Because oldsquaw are by far the most abundant species in the nearshore environment, they are the species that could suffer the highest losses due to an oil spill. Although other species, such as loons, could contact a potential oil spill and die, very few individuals of such species would be involved because of their low abundance in the marine environment. The consequent losses would be insignificant to the populations.

Also, the text in Section IV.B.3.a(1)(b) has been revised in partial response to this comment.

Response 2-6

Bird species with low local subpopulations such as the commenter's example--snow geese--are likely to suffer insignificant loss due to an oil spill. The snow geese of Howe Island are not a discrete population; they interbreed with the Banks Island population in Canada and the Soviet population on Wrangel Island. Thus, recruitment from these areas can replace lost snow geese within one generation, and the population effect would be MINOR. Additionally, snow geese do not frequent the marine environment but rather use the tundra habitats and saltmarshes, where they are far less likely to come in contact with oil. The chance of oil spills contacting coastal habitats near Howe Island is less than 10 percent. Thus, snow geese would not be expected to suffer any population-level effect (MODERATE or MAJOR) from the proposal alone.

Species with low or limited regional populations such as the yellow-billed loon are very likely to suffer the loss of no more than a few individual birds as a result of oil spills associated with the proposal. Such an effect probably would be insignificant to the population. If an oil spill contacted Thetis, Cross, Pole, or Egg Islands, the effect on common eiders would not represent 20 to 30 percent of the season's production of common eiders for the region because the majority of the common eiders nest on the mainland--only a small portion of the regional population nests on the barrier islands. An oil spill associated with the proposal is likely to contact only one lagoon system along the coast, not to contact the entire fall-migration population of any waterfowl or shorebird species; see Section IV.B.3(1)(b).

Response 2-7

The hypothetical offshore- and onshore-pipeline routes are discussed in Section II.A.4. The hypothetical onshore-pipeline routes across the southern part of NPR-A are shown in Graphic 6 and Oliktok Point in Appendix B, Figure B-2.

Response 2-8

The potential effects on caribou of a cumulative network of pipelines and roads across the North Slope is considered in the analysis of cumulative effects, Section IV.B.6.b. The conclusion is that cumulative roads and pipelines could have MODERATE effects on caribou-herd distribution. The analysis of the proposal and the cumulative analysis considers the fact that roads associated with potential development might be open to the public and that this public access could lead to overharvest of the caribou herds. Information on the effects of TAP and Prudhoe Bay development on caribou is the best information available for assessing the effects of development on other caribou herds. There is no evidence to indicate that effects on other herds would be different.

Response 2-9

The scenarios for oil exploration, development and production, and transportation are speculative. They are based on an estimated level of activities and scheduling of events associated with an estimated resource. Prudhoe Bay is the only place along the Alaskan Beaufort Sea coast that has port facilities and a road connecting it to other highways in Alaska, and it is located about midway along the Alaskan Beaufort Sea coast. Additionally, equipment and supplies can be hauled to the Beaufort Sea on marine vessels that can anchor at or near offshore or onshore construction sites. Given these conditions, it seems reasonable, at least for the present, to assume that Prudhoe Bay will be used to support major construction and operation activities that might occur as a result of Sale 97.

The general potential effects on tundra-habitat alteration and destruction that might result from onshore-construction activities associated with Sale 97 oil exploitation are in Sections IV.B.3 a(4) and (5) and IV.B.3.b(3) and (4) for birds and Sections IV.B.6.b(2) and (3) for caribou. Because the locations of both onshore and offshore facilities are unknown, site-specific information regarding possible affected terrestrial areas are more appropriately addressed in those environmental documents that might be required for onshore projects.

Response 2-10

As noted in Section I.B.1.b, laws, regulations, and orders that provide mitigation are considered part of the proposal. Under ANILCA, production of oil and gas from ANWR is prohibited and no leasing or other development leading to production of oil and gas from the range shall be undertaken until authorized by an Act of Congress; this prohibition is noted in Table IV-A-7. Because of this prohibition, it was assumed that any oil produced from Federal offshore leases north of ANWR would be transported via a marine pipeline at least as far as Bullen Point.

However, potential effects of Sale 97 on ANWR are addressed in Sections IV.B.3, Marine and Coastal Birds, and IV.B.6, Caribou. The possible tie-in of an offshore pipeline from Sale 97 to onshore infrastructure associated with potential ANWR oil development is considered in the referenced section on caribou. Also discussed in this section are the cumulative effects of an OCS and ANWR pipeline.

Response 2-11

Stipulations are prepared to mitigate potential adverse effects where no other laws, regulations, or orders are in place to provide such mitigation. In the case of causeways, a stipulation is deemed inappropriate because regulations are in place to potentially mitigate adverse effects. The construction of causeways is regulated by a permitting process administered by the U.S. Army COE under provisions of Section 404 of the Clean Water Act. Under this process, an environmental assessment would be made of several site- and design-specific alternatives that would allow the most environmentally-preferred alternative to be identified. Mitigating measures also could be required during this process.

Stipulation No. 5--Transportation of Hydrocarbons--sets forth criteria that must be fulfilled before subsea pipelines can be required.

Also, see Response 21-41.

Response 2-12

The Secretary of the Interior has the option of deferring from the Sale 97 proposal area any or all of the deferral areas analyzed in the FEIS or areas proposed after consultation with the Governor of Alaska, pursuant to Section 19 of the OCSLA, as amended.

Response 2-13

The Chukchi Deferral Area was also part of the area analyzed in the EIS for Sale 87--the third OCS oil and gas lease sale in the Beaufort Sea (formerly Diapir Field) Planning Area. The Sale 87 EIS analyzed the potential effects on the environment from petroleum exploitation.

The focus of the EIS on the resources and effects in the Beaufort Sea is appropriate. Approximately 800,000 hectares have been leased in the Beaufort Sea part of the Beaufort Sea Planning Area; none of the blocks in the Chukchi Sea part of the planning area have been offered for lease. Thus, leasing is anticipated to continue in the Beaufort Sea, but interest in the Chukchi Sea part of the planning area is an unknown factor. Additionally, (1) petroleum-exploitation activities in the Beaufort Sea could potentially affect many more resources and systems than in the Chukchi Sea and (2) the possible effects of petroleum activities on any resources of the Beaufort Sea would be essentially similar for the same resources in the Chukchi Sea.

The general effects of construction for an onshore pipeline that originates in the vicinity of Point Belcher are analyzed in the noise and disturbance and construction-activities discussions in Section IV.B. Furthermore, the onshore-pipeline route across NPR-A from Point Belcher to TAP Pump Station 1 is basically the same as that analyzed in the Sale 87 FEIS.

Although this comment contained no examples of the significant differences between the Beaufort and Chukchi Seas, the responses to specific comments that follow are assumed to address these concerns.

Response 2-14

The number of helicopter flights flown in direct support of Sale 97 exploration and development and production activities are discussed in Section II.A and summarized in Table II-A-1. During the 5- to 6-year exploration period, an estimated 1,350 flights will be flown; this is about 1 flight per day for this period. During the 1- to 2-year period when development wells are being drilled, an estimated 1,755 flights will be flown; this is about 2 or 3 flights per day. Because only a fraction of these flights may have to be flown at altitudes below 1,500 feet, it is not anticipated that the number of helicopter trips flown below 1,500 feet will have a measurable effect on the biological resources.

Response 2-15

ITL No. 2 has been amended to include the Colville River Delta and Cross, Pole, Egg, and Thetis Islands.

Response 2-16

MMS believes that potential lessees--many of whom testified at the ANWR Public Hearing in Anchorage, Alaska, on January 5, 1987--are well aware of the land status of ANWR; the status of ANWR is summarized in Appendix B.

Response 2-17

Although a specific reference had already been made in the text to note where the location and specifics concerning the algae could be found, the text in Section III.B.1.c(1)(a) has been expanded to include further details.

Response 2-18

Section III.B.3 has been amended to address this concern.

Response 2-19

In Graphic 3, tundra swan-concentration areas are shown only on ANWR because of the availability and accuracy of data--this species' habitats were studied and differentiated from other waterfowl on ANWR by Bartels and Doyle (1984) in the ANWR 1983 Update Report conducted by FWS. Graphic 3 also represents the Colville River Delta as a major concentration area for marine and coastal birds because of the high densities of other waterfowl species as well as tundra swans that occur on the Colville Delta. The Canning River Delta is listed as an area of Special Biological Sensitivity in ITL No. 2.

Response 2-20

Most polar bears in the Sale 97 area den on the sea ice; the locations of their dens vary greatly from year to year depending on ice and snow conditions. The locations of land dens also vary considerably from year to year; consequently, showing the land locations of past dens would misrepresent the importance of such dens to the polar bear population.

Response 2-21

Summer-movement-pattern arrows on Graphic 5 point to and from the coast as well as along the coast. Postcalving-concentration areas are highly variable from day to day, let alone from year to year--the postcalving aggregations of caribou generally are moving and can occur anywhere on the summer range. Any attempt to designate site-specific caribou-aggregation locations on Graphic 5 would misrepresent the distribution designations of the caribou herds. Only the calving ranges are geographically specific from year to year and can be meaningfully represented on Graphic 5.

Response 2-22

Graphic 6 has been revised to reflect the 1987 to 1991 proposed lease schedule of the State of Alaska.

Response 2-23

Potential effects to the Boulder Patch community are considered to be more significant, based on the observations of Dunton et al., 1982. However, some discussion of potential effects on these other kelp/algal assemblages has been added to the text in Section IV.B.1.a(1)(a).

Response 2-24

This concern is addressed in Response 2-5. Although Pacific, red-throated, and yellow-billed loons may feed in coastal lagoons or in offshore waters, these species do not occur in large numbers or in concentrations--very few individual birds of these species are likely to come in contact with oil spills, and MAJOR effects are very unlikely to occur. Neither are Ross's gulls and shorebirds such as phalaropes, dunlins, and sanderlings likely to be oiled by potential oil spills because they spend little time setting on the water in the marine environment. Thus, none of these species is likely to suffer high losses due to cumulative oil spills.

Response 2-25

The text in Sections II.A.4 and IV.B.6.a(3)(a) has been clarified.

Response 2-26

The assumptions for the pipelines associated with Sale 97 and previous lease sales are discussed in Section II.A.4. The data in Table II-A-1 have been revised to reflect the corrected length of the pipeline from Bullen Point to TAP Pump Station 1.

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United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092

In Reply Refer To:
WGS Mail Stop 423

JAN 6 1987

Memorandum

To: Regional Director, Minerals Management Services, Anchorage, Alaska

From: Assistant Director for Engineering Geology

Subject: Review of draft environmental statement for the proposed 1988 OCS Oil and Gas Lease Sale 97, Beaufort Sea, Alaska

We have reviewed the statement as requested in your memorandum of November 10.

There is a high probability that oil spilled in the Beaufort Sea will contact land. Also pipelines are expected to come ashore at various points. Onshore facilities, including large storage tanks will probably be necessary during production. We suggest that the potential for impacts on ground-water resources should be considered. Oil can penetrate the sands and gravels of the coastal area, thus slowing biodegradation processes. Some components of crude oil are reportedly very persistent in ground water 1,2/. Mitigation of related impacts should be addressed. 3-1

for James F. Devine

1/ Duffy, J.J., Mohtadi, M.F., and Peak, E., 1977, Subsurface Persistence of crude oil spilled on land and its transport in ground water, in American Petroleum Institute, Environmental Protection Agency, and U.S. Coast Guard Proceedings 1977 Oil Spill Conference, March 8-10, 1977, New Orleans, Louisiana: p. 475-478.

2/ Raisbeck, J.M., and Mohtadi, M.F., 1974, The environmental impacts of oil spills on land in the Arctic regions: Water, Air, and Soil Pollution 3 (1974), p. 195-208.

Copy to: District Chief, WRD, Anchorage, Alaska

Response 3-1

Shoreline oiling and persistence of oiled shoreline are discussed in Section IV.A.2.b. Onshore groundwater is not at risk from Sale 97. There is a 23-percent chance that at least one oil spill of 1,000 barrels or greater could occur and then contact land within 10 days during the open-water season. The land contacted would most likely be a narrow, meter(s)-wide strip of shoreline. Weathered or even fresh crude has little tendency to penetrate into the cold, water-saturated peats that predominate on the mainland shore (see Sec. IV.A.2.b). Even if a spill penetrated the seasonally thawed surface layer of soil, permafrost of a few-hundred-meters thickness would still isolate the oil from groundwater resources.

The possibility of groundwater pollution from leaky onshore-storage tanks during production is not considered because all offshore oil would be piped into the TAP: no large onshore-storage tanks would be built for produced oil from Sale 97.

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United States Department of State 4

Bureau of Oceans and International Environmental and Scientific Affairs

Washington, D.C. 20520
January 23, 1987

Regional Director, Alaska OCS Region
Minerals Management Service
949 East 36th Avenue, Room 110
Anchorage, Alaska 99508
Attention: Dick Roberts

Dear Mr. Roberts:

I regret the delay in submitting these comments on the Draft Environmental Impact Statement on Beaufort Sea Lease Sale 97, but copies of the draft only became available to the Department of State subsequent to your January 6 closure date. I hope that the following comments will nonetheless be of value to MMS in preparing the final EIS.

Although the area evaluated for possible leasing abuts the boundary area with Canada, and possible environmental activities in the lease area clearly could have environmental impacts on the Canadian side of the boundary area, or in areas beyond Canadian or U.S. jurisdiction, there is no clear reference in the draft to such possible impacts, as required by Executive Order No. 12114, dated January 4, 1979. We believe this order, titled "Environmental Effects Abroad of Major Federal Actions," should be referred to in paragraph 6 on page I-3 as one of the legal and administrative bases for the environmental review, and appropriate references should be made in the EIS to situations where specific actions, events or mitigating measures could have or could eliminate a "spillover effect" on the Canadian side of the border. 4-1

For example, while there are actually some implicit negative findings, such as an elimination or reduction of the impacts of certain activities on bird or mammal habitats "east of Kaktovik" under Alternative V, there appears to be no systematic approach to the question of crossborder impacts in relation to key issues such as, e.g., possible oil spills, under any of the analysis done in relation to the proposed action or the several alternatives studied.

If the Department of Interior has concluded that the proposed action or alternatives will not "significantly affect the environment" (as defined in E.O. 12114) of Canada, thereby obviating the need for such assessment in the draft EIS, we would appreciate information about the basis for the conclusion and the process by which it was arrived at. In this regard, we understand that the Department of Interior does not have its own procedures for implementation of E.O. 12114, and we, in conjunction with the Council on Environmental Quality, would be pleased to assist appropriate Interior officials in Washington concerning this matter. 4-2

In another aspect of this international connection, we note that there is no reference in the draft EIS to consultation or coordination with any Canadian authorities or sources in the scoping for or preparation of the draft EIS. Further, one specific place where it would have appeared that some reference to potential cooperation with Canada would have been particularly relevant is in the section on oil spill contingency measures starting on page IV-A-13. That is, in section A.2.c., we did not note any mention of the U.S.-Canada Joint Marine Pollution Contingency Plan. It would seem appropriate to refer to this Agreement, which extends to the Beaufort Sea, in the EIS. 4-3

Another important subject in relation to which we believe there should be some mention of Canadian interest is the Porcupine Caribou Herd. There is significant discussion of the PCH starting on page IV-B-13, but no reference that we discerned concerning the international nature of the Herd. Apropos this issue, we suggest the following be inserted in the section marked "conclusion", on page IV-B-68: 4-4

> "The United States and Canada initialled a draft agreement on the conservation of the Porcupine Caribou Herd in December 1986. The agreement would provide for an International Porcupine Caribou Board to share information on the conservation of the herd, assist in cooperative conservation and planning for the herd throughout its range, review available data and, as necessary, make recommendations to the respective governments concerning matters which affect the herd or its habitat."

We would also suggest referring to this language under the sections in the paragraphs marked "caribou" for the alternative proposals, (pages IV-D-2, IV-E-6, IV-F-5 and IV-G-5). This appears relevant to the goals of this EIS since it provides information concerning concrete efforts (albeit not finalized) to minimize possible adverse environmental impacts of actions in the caribou habitat. 4-5

On another issue, I would note that figure 1-1 (map showing the Beaufort sea planning area), following page I-9, portrays blocks east of 141°E. as having been leased. Our understanding, as described on page I-6, of the draft EIS, is that no blocks have been leased in the area of dispute east of 141°E. Instead, monies from bids for sale 87 have been put in escrow. We suggest correction of the map to make it consistent with the section I.A. "Leasing History" outlined on page I-6, and the present leasing status. 4-6

Finally, with respect to the statements by the Yukon Territory objecting to the inclusion of areas claimed by Canada in sale 97, we suggest the following response: 4-7

> "The United States has advised the Government of Canada by Diplomatic Note that it does not accept that any part of lease sale 97 encroaches on Canada's sovereign rights in international law and that it does not share the Canadian view that the location of the maritime boundary in the Beaufort Sea follows the 141 st Meridian. However, in recognition that there is no agreed maritime boundary and that part of sale 97 is subject to an overlapping claim by the Government of Canada, the United States has advised the Government of Canada that this part, like sale 87, will be subject to special procedures. Pursuant to these procedures, which are without prejudice to U.S. interests or a future settlement, the Department of Interior will place in escrow the highest acceptable bids for tracts in the disputed area. Such procedures do not constitute an acceptance or rejection of a bid for purposes of granting leases."

Sincerely,

Paul J. Glasoe
Environmental Assessment Coordinator

CC: CEQ - Dinah Bear
MMS - Richard Miller

Response 4-1

Although the Beaufort Sea Sale 97 is a major Federal action, it does not qualify under Section 2-4(b) of Executive Order No. 12114 as significantly affecting the "environment," as defined in Section 3-4, and action doing "significant harm to the environment."

The Department has complied with Section 3-5 with the preparation of this document. The EIS that is prepared for a lease sale is generic in that it serves the decisionmaker in deciding, among other things, whether or not to hold the lease sale. Until MMS receives a site-specific plan from a lessee, it does not have the ability to make specific findings. If, however, prior to any exploration or development and production phases or during MMS monitoring of any OCS activities it is determined that the environment, including the Canadian environment, is significantly affected, an EIS will be prepared and procedures in Section 2-4 will be fully applied.

The concern regarding oil spills is addressed in Reponse 21-55.

Since the DEIS was published, there has been a joint U.S.-Canadian meeting to discuss Arctic fisheries and the marine mammal and fish species of mutual concern. Communication has increased, and possible joint-research projects are being developed. Concerns regarding caribou are addressed in Response 4-4.

Response 4-2

The effects on the natural and physical resources in the proposed lease-sale area are expected to be MINOR, except for a possible MODERATE effect on marine and coastal birds. The area outside the lease sale would not exceed these effect levels and in most cases would be either MINOR or NEGLIGIBLE. The net transport of oil spills from offshore sources moves from east to west, away from Canadian waters.

Potential oil spills originating in the Canadian Beaufort Sea from Canadian platforms, pipelines, and tankering would be transported into the proposed lease area. These potential events have been considered in the cumulative-case analysis.

Response 4-3

Section IV.A.2.c has been amended to include a discussion of the Canada-U.S. Joint Marine Contingency Plan.

Response 4-4

The international nature of the Porcupine caribou herd (PCH) is noted in Section III.6, and calving areas and movement patterns are shown in Graphic 5. A brief description of the Draft International Agreement on the PCH has been added to Section IV.B.6.b.(5).

Also, see Response A-38.

Response 4-5

Reference to the draft agreement between the U.S. and Canada on the conservation of the Porcupine caribou herd is not relevant to discussions of the delay the sale alternative in Section IV.D.6 or the deferral alternatives in Sections IV.E.6, F.6, and G.6. A 2-year delay in Sale 97 would not be expected to affect the timing of development on existing leases from Sale 87. Neither is deferral of additional lease sales offshore of ANWR expected to greatly influence ANWR exploration or development. The fact that the Porcupine caribou herd calving grounds are on a national wildlife refuge has far more legal protection for the caribou herd and its habitats than the above draft agreement.

Response 4-6

The map has been corrected to reflect the proper status of bids received in the contested area; see Section I.D.

Response 4-7

Section I.B has been amended to include a discussion of the jurisdictional controversy between Canada and the United States on the Sale 97 eastern sale boundary.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

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JAN 0 9 1987

REPLY TO ATTN OF M/S 443

William Bettenberg, Director
Minerals Management Service
Department of the Interior
Washington, D.C. 20240

Dear Mr. Bettenberg:

The Environmental Protection Agency (EPA) has reviewed the draft Environmental Impact Statement (DEIS) for the proposed Outer Continental Shelf (OCS) Oil and Gas Lease Sale 97 in the Beaufort Sea. Our review was conducted in accordance with the National Environmental Policy Act (NEPA) and our responsibilities under Section 309 of the Clean Air Act.

EPA has been involved with this EIS for over a year. We requested to be a cooperating agency in the preparation of this EIS in scoping comments submitted in March 1985. EPA and the Minerals Management Service (MMS) agreed that EPA would prepare an appendix to the EIS dealing with the fate and effects of exploratory phase oil and gas drilling discharges. MMS provided us with a preliminary draft of the water quality and air quality sections of the EIS in February 1986 and comments were provided on these sections. We now offer the following comments on this DEIS.

We noted several changes and improvements in this DEIS compared to past EISs for lease sales in the Beaufort Sea. EPA has commented on several occasions in the past that there should be separate impact definitions for threatened and endangered species that reflect their vulnerability and sensitivity to further stress and impacts. This DEIS presents new impact definitions for endangered species that are different from the impact definitions for other biological resources. This DEIS has an expanded discussion of the feeding relationships and impacts to these relationships. The impact assessment section considers the availability of food sources to predators. We noted the greatly expanded subsistence discussion; it provides much useful information. This EIS also has a new layout; the table of contents at the beginning of each section facilitated our review.

We have several concerns that are summarized in the paragraphs that follow. Our concerns are fully described in our attached detailed comments. Most of our comments are aimed at improving the data base for decision making on the leasing options for the proposed 21 million acre sale area.

Existing Environment

There are significant data gaps with regard to the northern Chukchi Sea portion of the sale area, fishery resources and their dependence on the coastal ecosystem, the importance of the eastern Bowhead whale feeding area, and the effects of drilling activities on the Bowhead whale fall migration.

We have suggested additional information that is needed to strengthen the existing environment discussion. An adequate discussion of the biological resources, habitat values, and feeding relationships is needed in order to provide an appropriate framework upon which to base the analysis of impacts and the suitability of leasing.

Environmental Consequences

We are concerned that the approach used to assess impacts has resulted in an understatement of the significance of these potential impacts. We believe that the impacts are understated for several reasons.

First, we are concerned about the possibility that several of the effects from a variety of activities could cause a more severe or serious effect than is anticipated from any one effect-producing activity. The DEIS provides no real synthesis of the combined effect of a variety of activities. The potential exists for a "synergistic" response: several minor effects associated with various activities could result in a moderate or major effect to a resource. 5-1

Second, we believe that the analysis of the proposed action apart from the numerous on-going projects on the North Slope is not representative of the current oil and gas industrial development occurring in the area. The impacts associated with the cumulative case analysis are more realistic and representative of the current oil and gas development situation. 5-2

Third, more prominent use and display of seasonal conditional probabilities would improve the discussion of oil spill impacts. Conditional probabilities represent the probability that if oil is spilled at a specific location it would contact either land or a biological resource. The conditional probabilities give the EIS reviewer a better understanding of what resources could be at risk if oil is spilled. This information is essential in order to assess the significance of oil spill impacts. Where the habitat or resource is particularly critical (i.e., an endangered species or primary feeding area), such that any spill could have serious impacts on a population or habitat, the decision-maker and the public should see not only the combined probabilities incorporating risk of a spill occurring (as is the case for this DEIS), but also the conditional probabilities. 5-3

Finally, our detailed comments provide numerous instances of information that we believe is not adequately considered in the DEIS. These information gaps, in the aggregate, weaken the conclusions drawn regarding the environmental consequences described in the DEIS. We believe that a more thorough description of several ecosystem relationships will result in a projection of more serious impacts.

Alternatives

Our major concern for this lease sale is with the scope of the proposed action itself. The DEIS analyzed six alternatives: I-The Proposed Action, II-No Sale, III-Delay the Sale, IV-Barrow Deferral, V-Kaktovik Deferral, and VI-Chukchi Deferral. We believe that all three of the deferral alternatives deserve special consideration.

Leasing in this area will pose some degree of risk to the biological resources, habitat, and human populations and their associated socioeconomic systems. Based on the cumulative effects of oil and gas exploration and development in the Beaufort Sea region, numerous major and moderate effects have been identified. Given the sensitivity of the biological resources and the natural stresses which they must survive, any additional stresses or impacts could be significant. Each deferral alternative represents some reduction of the risk of spilled oil affecting biological resources and habitat. Deferral of blocks would also eliminate noise and disturbance effects.

The Barrow deferral alternative provides protection to the Bowhead whales during their spring migration. It is well established that the blocks proposed for deferral are of critical importance to the whale spring migration. We strongly support this alternative.

There are significant information gaps associated with the Chukchi and Kaktovik deferral areas. These gaps represent unknowns and uncertainties that warrant a careful leasing approach that attempts to balance concerns about biological resources and habitat with leasing decisions.

We recommend that MMS reconsider the inclusion of the Chukchi deferral area in this sale until more basic environmental information can be gathered. Delaying the sale in this area will allow more time to gather data before the next Beaufort Sea lease sale.

In the case of the Kaktovik deferral alternative, we believe leasing decisions in this deferral area should wait upon the analysis of the results from studies recently conducted to assess the importance of the Bowhead whale feeding area (within the deferral area) and the effects of drilling activities on Bowhead whale fall migration. We suggest that MMS incorporate in the FEIS the results from these studies if they are available. This will provide EIS reviewers with the necessary information for commenting on the lease sale configuration and the acceptability of impacts. 5-4

Mitigation

We support the proposed stipulations and Information to Lessees (ITLs) presented in the DEIS. We will reconsider these mitigation measures in light of any new information presented in the FEIS.

Water Quality and Air Quality

We are restating many of the concerns that we expressed in our comments on the preliminary draft water quality and air quality sections. We are providing several suggestions for improving the discussions found in these sections.

Conclusions

The simple and direct nature of the Beaufort Sea feeding relationships makes it more sensitive and vulnerable to impacts. Additionally, the natural stresses that the biological communities must survive make them particularly sensitive to any additional human caused effects. For these reasons, we believe that any additional impacts should be considered significant.

Numerous potential moderate and major impacts to fish, marine and coastal birds, the endangered Bowhead whale and the habitats on which they depend, and the subsistence use of these biological resources are identified in the DEIS. We believe that the deferral alternatives represent some reduction of the risk of spilled oil affecting biological resources and habitat. These alternatives would also reduce noise and disturbance effects to birds, marine mammals, and subsistence hunting activities.

The DEIS has identified significant environmental impacts associated with the proposed action. We believe that these adverse impacts could be reduced by implementation of any or all of the deferral alternatives in conjunction with implementation of appropriate mitigation. On this basis, we are rating the proposed action, Alternative I, EC-2 (Environmental Concerns - Insufficient Information). The "insufficient information" rating is based on the need for more comprehensive and detailed discussions in the Existing Environment Sections, the need for the Bowhead whale study results, and a revised analysis of impacts. We believe that the noted data gaps and revisions of impact analysis in this DEIS are significant. Once again, we strongly recommend you adopt the Barrow deferral. If the FEIS does not adequately address them EPA may need to supplement the FEIS before issuing a permit that regulates new sources. 5-5

Thank you for the opportunity to comment on the DEIS. We would like to meet with you to discuss our concerns with this proposed acton. If you have any questions, please feel free to have your staff contact Dan Steinborn at (206) 442-8505 or Salli Brough at (206) 442-4012.

Sincerely,

Robie G. Russell
Regional Administrator

Enclosure

SUMMARY OF THE EPA RATING SYSTEM
FOR DRAFT ENVIRONMENTAL IMPACT STATEMENTS:
DEFINITIONS AND FOLLOW-UP ACTION *

<u>Environmental Impact of the Action</u>

LO--Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities with no more than minor changes to the proposal.

EC--Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EO--Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU--Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

<u>Adequacy of the Impact Statement</u>

Category 1--Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2--Insufficient Information

The draft EIS does not contain sufficient information for EPA fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3--Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment

U.S. ENVIRONMENTAL PROTECTION AGENCY
BEAUFORT SEA LEASE SALE 97 DEIS
DETAILED COMMENTS

INTRODUCTION

As noted in our letter, there are several aspects of the DEIS which could be revised and expanded to strengthen the document and give the Secretary and the public a clearer picture of the environmental results of oil and gas development within the proposed 21 million acre sale area. Our discussion of concerns and recommended changes to the EIS follows.

EXISTING ENVIRONMENT

Chukchi Information Needs:

Section III of the DEIS contains little site-specific information about the extreme western portion of the proposed lease sale area in the Chukchi Sea. The environmental characteristics of this area are sufficiently different to warrant separate analysis. There appear to be few if any on-going or proposed research efforts in this area to address environmental information needs. 5-6

There are no data for benthic communities and fishery resources in the Chukchi Sea. The trophic discussions for lower trophic level organisms and fish are focused on Beaufort Sea (not Chukchi Sea) energy/carbon transfer relationships. The broad shallow Chukchi Shelf could have significantly different energy transfer dynamics. 5-7

The FEIS should provide more site-specific information about the biological resources found on the Chukchi shelf, the trophic structure and energy transfer dynamics. If there is no such information, the FEIS should clearly state that data are lacking. If the EIS analysts assume for the sake of impact analysis that the biological communities and trophic structure of the northern Chukchi Sea are similar to the Beaufort Sea, this should be discussed. A rationale for this assumption should be provided. 5-8

Fishery Resources:

We have several concerns with the Existing Environment discussion of fish resources and habitat in the Beaufort Sea. As you may be aware, EPA is involved in reviewing extensive water quality monitoring efforts associated with the West Dock and Endicott Projects. Minor water quality effects resulting from the causeways built for these projects are suspected of having the potential for significant adverse impacts on the fish resources in the Beaufort Sea. Therefore, our involvement in these water quality monitoring efforts has also provided us with extensive data on the fish resources and their habitat use of the inshore and nearshore waters of the Beaufort Sea.

Pink salmon are marginal members of the anadromous fish fauna in the Alaska Beaufort Sea. The DEIS' discussions of fish resources focuses on this species rather than the many other arctic anadromous species (Arctic char, Arctic cisco, etc.). 5-9

It is not apparent that the biology of the different fish species and their local availability were factored into the subsistence fisheries analysis in Section III. The discussion of subsistence fishing provides little discussion of the variation in the subsistence use of fish among the different villages. The DEIS uses the same species list for each village. The FEIS would be greatly improved by providing village-specific discussions of the species important to the subsistence uses of each village. 5-10

The DEIS describes the anadromous species as pelagic. Arctic cisco, Arctic char, least cisco, and broad whitefish are not truly pelagic in the Beaufort Sea. These species inhabit waters that vary in depth from 1.5 to 5 meters. This shallow water habitat can be classified more as estuarine or coastal than pelagic. The FEIS should clarify the use of the shallow nearshore and inshore areas by anadromous species. 5-11

The FEIS should expand the discussion of the importance of the coastal nearshore ecosystem to anadromous species. Juveniles, non-spawning, and post-spawning fish are all found in the coastal environment. The DEIS states that this area is used by juveniles, however, more than one year class uses the nearshore area. 5-12

Related to the importance of the coastal ecosystem to fish species is the importance of coastal feeding habitats to population dynamics of Arctic fish species. The DEIS does not provide an adequate discussion of the annual energy budgets of anadromous fish. Successful summer feeding is of critical importance to population dynamics and recruitment. Food energy from the coastal environment is important for overwintering survival, fecundity, egg size, growth, and maturation. The FEIS should provide a more detailed discussion about the importance of coastal feeding habitats to population dynamics. This will provide an appropriate framework as a basis for the assessment of impacts. 5-13

Bowhead Whale Information Needs:

Major concerns were expressed for Sale 87 about the effects of oil and gas activities on bowhead migration and feeding, specifically in the eastern portions of the sale area. In spite of these concerns, leasing was conducted in the eastern portion of the sale area in Sale 87, and environmental studies were conducted in 1985 and 1986 to address these concerns. Studies were initiated to assess the behavioral responses of bowhead whales to drilling activities during their fall migration and the importance of the eastern area as a bowhead whale feeding area. The results from these studies are not currently available. 5-14

We strongly suggest that MMS make every effort to obtain the results of these studies and incorporate the findings into the FEIS. It is critical to understand the importance of this area as a feeding area. It is also essential to determine the behavioral responses of bowheads to exploration activity. Again, this provides an appropriate framework upon which to base the analysis of impacts. This information is also needed for proper evaluation of the effectiveness of the proposed mitigation measures and the need for additional mitigation.

Polar Bears:

The Arctic National Wildlife Refuge (ANWR) Coastal Plain Resource Assessment draft legislative EIS (LEIS) provides useful information about the status of the arctic polar bear population. The draft LEIS indicates that 87 percent of polar bear dens in 1983 to 1985 were located offshore. They could therefore be adversely affected by OCS activities. The draft LEIS also indicates that the Beaufort Sea population can sustain little, if any, increase in mortality of females. Population estimates indicate that the number of animals dying each year is approximately equal to the population increase from reproduction (p.118 ANWR LEIS). This information is not clearly presented in the DEIS for this sale. The FEIS should discuss more fully the population dynamics of polar bears and the fact that the population may not be able to survive perturbations that would result in the death of individuals or decrease the reproductive rate. **5-15**

Water Quality:

A more detailed discussion of our concerns about water quality can be found in the pages that follow. We would, however, like to point out that the criteria values presented on Table III-D-2 in Section III should be updated using 50 FR 30784. EPA has not set "Dissolved" saltwater criteria. This should be corrected in the FEIS. **5-16**

ENVIRONMENTAL CONSEQUENCES

Combined Effects:

We have several concerns about the impact analysis presented in the DEIS. First, the conclusion statements imply that the "combined effects" from all effect-producing activities (oil spills, drilling discharges, construction activities) will be no greater (or less) than the effects from any individual effect-producing activity. We are concerned about the possibility that several of the effects from a variety of activities could interact to cause a more adverse or serious effect than is anticipated from any one activity. Is it possible that several MINOR effects from various activities could result in a MODERATE or MAJOR effect? **5-17**

The DEIS provides no real synthesis of the combined effects of a variety of activities. Some discussion of the likelihood of a biological resource encountering a combination of activities within a given time frame (24 hours, week, month, migration period, molting period, staging period, etc.) is needed to support the combined effects conclusion. This is particularly important given the sensitivity of the biological resources and the natural stresses which they must survive. **5-18**

Cumulative Effects:

There appears to be a significant difference between the potential impacts associated with the proposed action and the deferral alternatives and the impacts associated with the cumulative case. The cumulative effects are more adverse for most resource categories than those for the proposed action alone.

We believe that the analysis of the proposed action apart from the numerous on-going projects is not representative of the current oil and gas industrial development occurring in the area and may underestimate the impacts. **5-19** We also recognize that the cumulative impacts analysis includes numerous future projects and may overestimate the impacts from existing activity and development.

Accordingly, we believe that focusing attention on the impacts associated with the cumulative case analysis is more representative of the current oil and gas industrial development situation on the North Slope. Because the cumulative analysis takes into account many future projects, focusing on the cumulative impacts will be an environmentally conservative approach for assessing the impacts from the proposed alternatives in conjunction with on-going projects. **5-20**

Conditional Probabilities:

We commend MMS for presenting seasonal conditional probabilities. We would like to recommend, however, that conditional probabilities be used more extensively in the environmental consequences discussion. We felt that the Norton Basin Sale 100 DEIS and FEIS represented a significant improvement over past Alaskan OCS lease sale EISs, specifically because the Norton Basin EISs relied on the annual and seasonal conditional probabilities rather than annual combined probabilities for impact assessment. Use of conditional probabilities (annual and seasonal) for assessing environmental consequences allows the EIS reviewer to:

- identify launch points that represent the greatest risk to vulnerable/sensitive habitats and biological communities;
- identify the targets (sea, ice, biological resource areas, land segments) most likely to be contacted by spilled oil;
- determine the season that these targets are most susceptible to oil contact;
- determine if the seasonal risk of oil spill contact corresponds with the seasonal presence of biota; and
- distinguish clearly the differences in oil spill risk between the proposed alternative and the deferral alternatives.

5-21

We believe this approach is more informative and more conservative. Use of annual and seasonal probabilities identifies the environmental effects, their potential scope, and their magnitude, assuming a spill occurs. Since the risk of spilling oil can never be completely eliminated, conditional probabilities represent an extremely useful tool for impact assessment. 5-22

This recommendation appears to agree with the approach already taken by the MMS EIS analysts. The responses to comments found in the Norton Basin FEIS (response 1-13) indicate that the EIS analysts use combined annual, combined winter, combined summer, annual conditional, winter conditional, and summer conditional probabilities to determine the seasons and the areas in which the resources may be particularly vulnerable to oil spills. 5-23

The environmental consequences discussion references primarily the combined probabilities. If the other probability numbers are generated for use in impact analysis, they should be incorporated into the environmental consequences discussion. Specifically, as we discussed in the paragraphs above, we recommend more extensive use and visibility of the seasonal conditional probabilities in the environmental consequences discussion. 5-24

Combined probabilities combine the conditional probabilities with expected spill rates, transportation scenarios, and the unrisked mean-resource estimates. They provide an assessment of the probability that oil will be spilled and contact resources. This is important information. However, if the probability of spill occurrence is low, it does not logically follow that the effect of a spill will be negligible. Therefore the probability of an oil spill should be separated from the direct assessment of impacts. Thus, the conditional and combined probabilities both provide important information to the decision-maker, but conditional probabilities are needed so that the public and decision-makers can fully assess the significance of potential impacts. 5-25

Using the information from the oil spill trajectory analysis as well as the combined probabilities allows EIS reviewers to make a reasoned judgment about the need for additional mitigating measures or potential deferrals of launch point areas that pose a significant risk to critical habitat or sensitive biota. 5-26

Adequacy of Impact Conclusions:

Our final concern about impact assessment is related to the deficiencies that we noted previously in the existing environment discussion. In general, the impact analysis is based on a thorough understanding of the biological resources found in the area; the dependence of these populations on habitat that supports various activities and life stages; the availability of various habitat types; the population dynamics of a species and its ability to cope with perturbations; and the trophic relationships that exist among species

groups. The DEIS in several instances has not presented a thorough description of some of these general ecosystem relationships. Thus, we are concerned about the adequacy of some of the impact conclusions. A more detailed discussion of our concerns follows.

Fishery Impacts:

The impact analysis uses salmon as a reference species. They do not represent a major proportion of the arctic fish fauna. We recommend that the discussion and impact analysis in the FEIS should be focused on species like Arctic char and Arctic cisco. 5-27

The oil spill effects analysis is based on the premise that Arctic char, Arctic cisco, least cisco, and broad whitefish are pelagic. As we pointed out in the previous section, these species are not truly pelagic. They inhabit estuarine or coastal habitats. By assuming they are pelagic, the potential effects of an oil spill on these species are understated. 5-28

More than one year class of fish would likely be affected by an oil spill contacting the nearshore area, contaminating the water column, and potentially the sediments. An oil spill could affect the total population comprised of all year classes and not just the juveniles upon which the DEIS focuses. The nearshore area represents both rearing and feeding habitat for entire anadromous fish populations. 5-29

The effect from an oil spill would not necessarily involve direct mortality of the fish present in the affected area. Any loss of time from the critical feeding period (early open water period) could affect annual energy budgets. Spilled oil during spawning could affect spawning runs and spawning habitat. An oil spill just before freeze-up could act as a barrier to fish reaching their overwintering habitats. All these non-lethal effects could significantly affect population dynamics and future recruitment. 5-30

The DEIS concludes that a MODERATE effect is possible based on the assumption that a single year class would be affected. Since an oil spill could affect more than one year class, a MAJOR effect should be considered. 5-31

Anadromous fish distribution, movement, and habitat could be affected by pipeline installation, dredging activities, and causeway construction. Overwintering habitat could be affected by dredging. Depending on the duration of construction activity, construction could affect fish movement and distribution. Causeways, built to allow pipelines to reach shore or built in association with oil and gas exploration and development, could disrupt longshore transport and affect temperature and salinity. These effects could adversely affect population dynamics and recruitment which could result in more than a MINOR effect. 5-32

Bowhead Whales:

The DEIS discusses the effects of noise and disturbance on Bowhead whales. It identifies in several instances that Bowhead whales have exhibited behavioral responses to noise producing activities from two to seven kilometers away. The conclusion statement on page IV-B-54 states that "whales may avoid feeding within several hundred meters of drilling units and production platforms." This would appear to be inconsistent with the information presented in the previous pages of the EIS. It also understates the potential effects of noise and disturbance. The results of ongoing studies to address this issue are not available. 5-33

The "several hundred meters" value is used in numerous instances in the environmental consequences discussion for all the alternatives as well as the worst case analysis. The conclusion of MINOR effects may not be supported by the available data. MODERATE or MAJOR effects could potentially occur. The FEIS should evaluate the effects from noise in light of the available data which indicate a larger areal extent than appears to have been used (several hundred meters) in the DEIS. 5-34

The results of studies to assess the behavioral responses to Bowhead whales to drilling activities during their fall migration and the importance of the eastern portions of the sale area as a Bowhead feeding area are needed. Without this information, it is difficult to fully assess the effects of the proposed action and whether any of the deferral alternatives can offer a reduction in impacts to this endangered species. 5-35

Finally, the DEIS acknowledges (p. IV-B-17) that there have been few studies conducted for offshore fish. If there is a degree of uncertainty about the nature of these populations, their population dynamics, and any particularly critical habitats upon which they depend, then what is the basis for the MINOR impact conclusion? The FEIS should provide a more detailed discussion of why this conclusion is appropriate. 5-36

Polar Bears:

The conclusion statement (p. IV-B-37) appears to be in conflict with information presented in related documents. It is not apparent that the population dynamics of the North Slope polar bears have been fully accounted for in this conclusion. The polar bear population is in equilibrium. Recent analyses suggest that mortalities of female polar bears are now about the maximum the Beaufort Sea population can sustain without a corresponding decrease in population levels (ANWR LEIS p. 118). Any additional loss of individuals could represent a MODERATE or MAJOR effect. 5-37

ALTERNATIVES CONSIDERED

The proposed action will offer for lease 3,930 blocks (21.2 million acres) of the Outer Continental Shelf (OCS) in the Beaufort Sea and northern Chukchi Sea. The conditional mean economically recoverable oil resources of the unleased portions of the lease sale area are estimated to be 650 million barrels of oil (MMbbls). There is a 69 percent chance of recoverable oil being present. For the proposal, there is an 82 percent chance of one or more spills of 1,000 barrels or greater. For the cumulative case, there is a 99 percent chance of a spill greater than 1,000 barrels and a 65 percent chance of a spill greater than 100,000 barrels.

In addition to the proposed action, several other alternatives were evaluated. These alternatives include: II-No Sale, III-Delay the Sale for two years, IV-Barrow Deferral which would remove 201 blocks that have an estimated 20 MMbbls of recoverable oil, V-Kaktovik Deferral which would remove 161 blocks that have an estimated 90 MMbbls of recoverable oil, and VI-Chukchi Deferral which would remove 1592 blocks with an estimated 30 MMbbls of recoverable oil.

Leasing in this area will pose some degree of risk to the biological resources, habitat, and human populations and their associated socioeconomic systems. Based on the scale of the cumulative effects of oil and gas exploration and development in the Beaufort Sea region, numerous MAJOR and MODERATE effects have been identified. Given the sensitivity of the biological resources and the natural stresses which they must survive, any additional human induced stresses or impacts should be considered potentially significant.

Our major concern for this lease sale is with the scope of the proposed action itself. We believe that all three of the deferral alternatives deserve special consideration. Each deferral alternative represents some reduction of the risk of spilled oil affecting biological resources and habitat. Deferral of blocks would also eliminate noise and disturbance effects.

Alternative IV-Barrow Deferral:

The 201 blocks that would be deferred from leasing for this lease sale are of vital importance to bowhead whales during their spring migration. This area is also important to subsistence whaling activities. Deferral would eliminate the potential for oil spills affecting the corridor used for spring migration, habitat alteration, and noise and disturbance effects which could disrupt the bowhead whales during their migration through the area. 5-38

Additionally, the deferral of these blocks would provide some degree of protection to birds and marine mammals. Deferral would eliminate activity in the high density seabird feeding area near Point Barrow, provide some reduction in oil spill risk, eliminate noise and disturbance effects to the Plover Islands and Peard Bay areas, and eliminate bird habitat alterations due to construction activities. For marine mammals, deferral would reduce oil 5-39 spill risk to belugha whales, ringed, bearded and spotted seals, and walrus. This alternative would minimize noise and disturbance from air and boat traffic and interference with subsistence hunting activities. We supported this alternative for these same reasons in the previous lease sale (Sale 87).

Alternative V-Kaktovik Deferral:

Our concern in the past lease sale was the importance of these blocks as a feeding area for bowhead whales. We supported this deferral alternative for Sale 87 for this reason.

It is our understanding that studies were recently conducted (1985 and 1986) to assess both the importance of this area as a bowhead whale feeding area and to assess the effects of drilling activities on the bowhead whale fall migration. However, the results of these studies are not yet available and have not been used in the analysis of impacts in this DEIS. Thus, it is possible that information useful in balancing biological resource and habitat concerns with leasing decisions is not available. In making this decision, it is important to have more complete information relative to the areal extent and duration of whale use of the area. 5-40

Deferral of these blocks would reduce the risk of spilled oil contacting nearshore waters and land. This alternative would eliminate oil spill risks to birds from Kaktovik east including Jago and Beaufort lagoons. 5-41 For marine mammals, there would be a significant reduction in oil spill risk to offshore habitat. Deferral would eliminate disturbance effects on ringed seals and polar bears and reduce noise, disturbances, and habitat alteration from offshore construction activities.

For bowhead whales, there would be a slight reduction in oil spill risk to the spring migration corridor B. 5-42 The DEIS states that "bowhead feeding activities in the deferral area would be less disturbed under this alternative" (p. IV-F-5).

Alternative VI-Chukchi Deferral:

The environmental characteristics of the Chukchi shelf are significantly different than those found in the Beaufort Sea. The broad shallow Chukchi shelf and polar pack ice are biologically important and are not well understood. However, the existing environment discussion in the DEIS is focused on the Beaufort Sea. There is an apparent lack of environmental information available for this deferral area. Additionally, there appears to be little on-going research to fill the existing environmental information gaps (Table IV-D-2). The impact discussion for this alternative is "boiler plate" (especially for lower trophic organisms) and does not focus on site-specific biological resources and habitats. 5-43

This alternative will reduce the noise and disturbance effects and habitat alteration for birds and marine mammals. The oil spill risk to marine mammal habitats, especially walrus during the open water season, would be reduced by this alternative.

During their fall migration, bowhead whales migrate across the southern half of the deferral area. Deferral of the blocks in this area would eliminate noise disturbance, habitat alteration, and the risk of oil spills. 5-44

MITIGATION

We support the proposed stipulations and Information to Lessees (ITLs) presented in the DEIS. However, the Bowhead whale information that we identified is necessary in order to properly evaluate the proposed mitigation measures and their effectiveness for minimizing impacts. We expect to reconsider the mitigation measures in light of any new information presented in the FEIS.

WATER QUALITY

General Concerns:

As we stated in our review of the prelimimary water quality discussion for Sale 97, the description of water quality effects is general in nature. Often the spatial extent and timeframe of potential effects are described in nonspecific terms. Phrases such as: "relatively small area and short period of time, only in limited areas and for short periods," and "effects disappear shortly and were not spatially extensive," are used to characterize the effects on water quality. An order of magnitude estimate of the time and spatial extent would help to substantiate the impact conclusions. Quantifying the time and spatial extent of potential impacts is especially important since the definitions for the assessment of water quality effects do not specify timeframe limits for short-term and long-term impacts or limits on spatial extent for local and regional impacts. 5-45

When numbers are used, there is no supporting discussion about how they were derived (hectares affected by dredging). A brief sentence or two in most cases would describe the basis for the numbers and would improve the water quality effects discussion. Reference is made to a local toxic-threshold concentration, but there is no specific number given. Without more detailed information, we find it difficult to assess the conclusions that are presented.

Finally, it is difficult to separate water quality impacts from their associated biological impacts. Minor water quality effects could result in significant impacts on biota. For example, minor changes in temperature and salinity, as a result of causeway construction at West Dock and Endicott, could cause far-reaching impacts to fish populations. 5-46 Similarly, although minor water quality effects are identified for this lease sale EIS, the question is whether these changes will result in more than negligible or minor effects on biota. The FEIS should discuss the water quality impacts on fish.

Effects of Spilled Oil:

The discussion identifies situations where "degradation of existing pristine water quality is likely to occur." This statement should be tied to a direct comparison with any applicable state and federal criteria and standards. The FEIS should clarify if the "degradation" of water quality will involve any violations of water quality standards or criteria. 5-47

We remain concerned about sediment quality and contaminated sediment and how tar balls will affect water quality. The discussion on page IV-B-116 deals with the contamination of sediment with spilled oil. In one place it is stated that 40 percent of spilled Prudhoe Bay crude oil could persist as tar balls. A few sentences later, the range in deposition of oil in bottom sediments is given as 0.1 to 8 percent of slick mass. The implication is that this deposition range is also for tar balls. There appears to be a significant difference in the numbers for the amount of spilled oil reaching the bottom sediments. If the different numbers represent different processes, this should be explained. The discussion should be expanded to clarify how the oil is incorporated in the sediments and whether this differs from the process of tar balls sinking to the bottom. 5-48

The text provides generalized descriptions of impacts without identifying the site specific features in the lease sale area that might be affected. The second paragraph on page IV-B-117 states that advection and dispersion will reduce the toxic effect of oil fractions. It goes on to give two exceptions where this reduction in toxic effects, due to advection and dispersion, is not likely to occur: embayments or shallow water areas under thick ice and in rapidly freezing leads. Both of these situations occur in the sale area. 5-49

Specifically, which embayments or shallow water areas under thick ice in the lease sale area might be subject to the exception? What are the impacts likely to be in these areas where advection and dispersion are not likely to reduce the toxic effect of oil fractions?

The toxicity discussion is focused primarily on water soluble aromatics and the effects on the water column. The discussion also seems to be focused on "deep water." There is no discussion of nearshore/shallow water situations where spilled oil is more likely to contaminate sediments. In areas characterized by high suspended sediment loads (like the Beaufort Sea) the petroleum derived aromatic hydrocarbons will adsorb to suspended particles and sink to the bottom where they may be quite persistent. Based on this, we feel that sediment quality should be discussed in greater detail. How contaminated sediment will affect the overlying water quality should also be examined. 5-50

Finally, the DEIS identifies a MODERATE effect on water quality if there is a spill of 100,000 barrels or greater (p. IV-B-117). However, the conclusion statement states that this is an unlikely occurrence and that water quality effects from oil spills would be MINOR. Your response (15-19) to our 5-51

comments on the North Aleutian Basin EIS indicate that it is MMS policy to separate the probability that an oil spill would occur from the assessed effect of an oil spill. It appears that the impact assessment has been linked to the low probability of a 100,000 barrel oil spill.

Effects of Dredging and Gravel Island Construction:

The discussion of these two activities could be improved by estimating the turbidity and suspended sediment levels that could be encountered. We realize that there are several variables that could affect these values. A range of values under various conditions would provide adequate information. 5-52

Additionally, the discussion in the DEIS bases the analysis of effects on water quality from dredging activities on experience in other areas. This experience indicated that suspended sediment concentrations decreased in two to three hours and within one to three kilometers down current from the point of discharge. The time frame and spatial extent are based on the movement of sand.

The discussion found on page III-2 and the information presented in Figure III-3 of the DEIS show that sand is not the predominant surface sediment found in the lease sale area. Finer grained silt and clay are more prevalent. Silt and clay particles generally settle over a longer period and a larger area than do sand particles. Thus, using the temporal and spatial data from other areas where sand is the predominant sediment is not representative of the site-specific conditions. This approach could tend to minimize the temporal and spatial extent of the effects of dredging on water quality. 5-53

Effects of Drilling Effluent Discharges:

One of our major concerns with past lease EISs has been the quantity of muds and cuttings that would be recycled and subsequently discharged during development/production. The FEIS should clarify and discuss the recycling rate used for this EIS. A range of 20 to 80 percent (as found in the sale 109 Chukchi Sea preliminary water quality discussion) seems reasonable. This range of mud recycling rates represents a realistic approach considering the many contingencies that could result in less than optimum mud usage during the development of arctic fields. 5-54

The discussion in this section should also focus on the total quantity of drilling muds discharged during development rather than on the decreased quantity of drilling muds used per well during development. There will be an increase in total quantities of muds discharged during development compared to total mud discharge during exploration. This should be discussed in the FEIS. 5-55

The discussion about the discharge of cuttings compares the cuttings to natural sediment loading and implies that there will be no effect. Again, it is difficult to separate water quality effects from their associated biological effects. This approach appears to ignore that most of the natural sediment load is inshore of the potential discharge locations associated with this sale. Second, the cuttings grain size distribution should be compared to the grain size distribution associated with natural sediment. A difference in grain size distribution can have a major effect on benthic communities. Finally, the natural sediment load will have a certain amount of organic matter associated with it. Cuttings will not have significant quantities of organic matter. The organic matter content can be of critical importance to infaunal communities. 5-56

Formation waters are prohibited from being discharged in marine waters less than ten meters deep by the existing Beaufort Sea General NPDES Permit. Formation waters represent a potential source of hydrocarbon and heavy metal contamination. The volume of formation waters is an unknown (20-150 percent of the oil output volume) and represents a major concern if discharge occurs in shallow water. 5-57

The effects of production discharges (p. IV-B-120) have not been evaluated by EPA through the Ocean Discharge Criteria Evaluation (ODCE) process. These discharges are not planned to be included in any general NPDES permit in the future. They would receive individual permits after site-specific ODCEs have been completed. 5-58

Air Quality

We believe that air quality is an important issue for this lease sale. This is due to the likely high industry interest, the large number of on-going projects in and adjacent to the lease sale area, and the large number of unknowns regarding potential environmental effects on this sensitive arctic area.

We would prefer to see the results from air quality modeling presented in the FEIS. MMS went through extensive efforts to develop the OCD model and gain EPA approval of it. It should be used to model the worst-case air emissions for the more conventional pollutants. We understand that the applicability of the OCD model to the arctic climate is less than optimum. It is however an available tool that can be used for impact analysis. 5-59

The inert pollutant air quality modeling results (using MMS's Offshore and Coastal Dispersion model) should be presented in the FEIS for the cumulative case. The assumption could be made that both potential platforms are in the same block and three miles offshore as a worst case scenario. If the modeled onshore impacts are insignificant, there is no problem. If impacts are significant, appropriate caveats can be stated (such as platforms may be further offshore, controls can be applied to reduce emissions, etc.). The OCD model is inexpensive to use and can be run with readily available input data. 5-60

The VOC emissions on Table IV-B-5 appear high, and they could be of some consequence. The impacts of elevated VOC levels should be discussed in the FEIS. Modeling of the VOC emissions cannot be accomplished with the OCD model, nor would it be a simple analysis. We are available to work with you on the VOC issue to determine if there is an acceptable model that could be used. The model results could be used to better define and examine potential impacts. 5-61

Based on the results of the OCD model and perhaps a more extensive VOC analysis, it may be appropriate to develop an ambient air quality monitoring program, perhaps in the form of a leasing stipulation. Onshore air quality monitoring stations may be essential to establish existing air pollutant concentrations for the shore areas before significant OCS development occurs. These stations could also be used to track potential air quality degradation during and after development. 5-62

On page IV-H-3, in the air quality section under "Unavoidable Adverse Effects," the statement is made that "MODERATE degradation of air quality..." is expected from the proposal. Only "MINOR" air quality degradation is mentioned in Section IV-B-15, "Effects on Air Quality." This inconsistency should be corrected. 5-63

The potential long term effects of burning oil spills, and acidification damage to tundra from atmospheric sulfate deposition should be discussed on page IV-J-1 under "Relationship Between Local Short-Term Uses and Maintenance and Enhancement of Long-Term Productivity." 5-64

Throughout the "Effects on Air Quality" section (starting on p. IV-B-124) the term nitrous oxides is incorrectly used. The discussions should instead refer to either oxides of nitrogen or nitrogen oxides. Nitrous oxides refers to "laughing gas" and is of no concern from an air quality standpoint. 5-65

Response 5-1

The approach used in the EIS is to use a systematic method of examining effects on a species or species group from each effect-producing activity (oil spills, noise/disturbance, drilling discharges, etc.) and then examine effects from these activities in the aggregate. With this method, the conclusion for any species or species group can be no lower than the highest rating from any of the effects produced by any individual effect-producing activity. The variety of effect-producing activities are further considered in the oil-spill-risk and the cumulative-case analysis for each resource. Most effect-producing activities are short term, localized, and usually not additive; therefore, they are not "synergistic." Also, the probability of any two effects occurring at the same time and at the same place and to the same individuals in the population is extremely remote. "Synergistic" as well as "antagonistic" effects have been documented with some heavy metals and the combination of heavy metals and organic chemicals using lower-trophic organisms in controlled laboratory experiments. Quantitative potential synergistic effects with upper-trophic organisms in which two activities have a greater than additive effect have not been documented. Without more specific direction from the commenter, the present EIS methodology in determining effects should be more than adequate.

Response 5-2

The analysis of the effects of the proposed action is based on estimated scenarios that are as extensive and as up-to-date as can be made in advance of a lease sale; Tables II-A-1 and IV-A-1. These scenarios are associated with a mean-case resource estimate of 650 million barrels of oil for that part of the Sale 97 planning area offered for lease. Major current and proposed oil and gas projects are considered in the cumulative-effects assessment and are summarized in Table IV-A-7. We do not understand what is meant by representative.

Response 5-3

Conditional probabilities are tabulated in Appendix F and are prominently presented and discussed in Sections IV.A.1.c and IV.A.2.b. A conditional probability--the probability of contact with a resource target, assuming that a spill occurs at a specific location--is most useful in identifying which location is or is not contributing to the combined probability of oil-spill contact with a resource. However, conditional probabilities do not provide an estimate of the likelihood of resource contact with oil; conditional probabilities only indicate what habitat would be contacted if a spill occurred at a specific launch location. For example, placing a hypothetical launch point within a resource target creates a conditional probability of 100 percent that the resource target would be contacted by a spill occurring at the encircled launch point, regardless of how likely or unlikely spill occurrence at that location would be. An extensive modeling effort is not needed to conclude that if a spill occurred at a specific location it would contact that location, and such a conclusion would not provide meaningful information to a decisionmaker.

Response 5-4

Final results from the bowhead feeding study conducted in the eastern Alaskan Beaufort Sea should be available by June 1987. This will not allow time for their incorporation into the FEIS; however, the information will be available to the Secretary of the Interior prior to his decision on the lease sale.

Response 5-5

The MMS disagrees with the EPA's rating on this EIS regarding both the methods used to reach a rating and the statements made concerning the adequacy of the EIS. There is only one Federal standard on EIS adequacy--the CEQ Regulations. The criteria for an EIS in those regulations govern what needs to be considered and how it needs to be considered to be objective, complete, and adequate for decisionmaking.

This EIS has revealed the substance of likely environmental effects, has analyzed in depth the relevant facts, and has drawn from them realistic assessments of the degrees of effect considered potentially possible. The philosophy of the analyses is to emphasize a conservative approach to ensure that the outcomes are fully evaluated. These analyses consider regional and localized effects, which are gauged by an objective system (defined in advance) on a scale consistently applied. When the MMS receives a substitute analysis for a potential effect that can be rigorously, consistently, and objectively applied, we will give it full and objective consideration and use it if the facts warrant. Meanwhile, we do not share EPA's view that this EIS is "inadequate."

Response 5-6

This concern is addressed in Responses 2-1, 6-2, 6-3, and 21-11.

Response 5-7

Information on benthic invertebrates and fishes in the northeastern Chukchi Sea is presented in the DEIS, and additional information has been added to Sections III.B.1. and .2.

Response 5-8

The 97 EIS does provide site-specific information on important habitats of marine and coastal birds and marine mammals in the Chukchi Sea on Graphics 3 and 4. The information that is presented for the Beaufort Sea environment is more specific because the proposal would have more local effects on birds and mammals along the coast of the Beaufort Sea than in the Chukchi Sea.

The biological populations of birds and marine mammals of the Beaufort Sea and the northern Chukchi Sea are not only similar but for the most part are the same migratory populations. As expressed in Response 5-7, additional information concerning lower-trophic and fish resources in the northeastern Chukchi Sea has been added in Sections III.B.1 and .2.

Response 5-9

This concern is addressed in Response 21-39.

Response 5-10

Further discussion of fish species and their local availability has been added to Sections III.C.3.b(1)(g), (2)(g), (3)(g), and (4)(g) to provide additional information for the analysis of subsistence harvest of fish.

Response 5-11

This concern is addressed in Response 21-37.

Response 5-12

This concern is addressed in Response 21-38. The discussion in both Sections III.B.2 and IV.B.2 talks about use of nearshore waters by both adult and juvenile anadromous fishes, but this discussion has been enlarged.

Response 5-13

A more detailed discussion of the importance of the coastal habitats is made in Section III.B.2. Recent information on feeding habits of anadromous fishes is discussed, but no detailed energy budgets are available.

Response 5-14

This concern is addressed in Response 5-4.

Response 5-15

Pertinent information on the population dynamics of polar bears in the Beaufort Sea is discussed in Section III.B.4.b. The percentage of polar bear dens located in the Beaufort Sea region from 1983 to 1985 was 78 percent, not 87 percent (Armstrup, 1985). Sale 97 is very unlikely to result in a significant loss of polar bears or measurably reduce polar bear reproductive rates, regardless of whether the population is in equilibrium and/or natural recruitment. Under the proposal, only 15 exploration drilling units (a maximum of 3/year) and 2 production platforms would be located in offshore sea-ice habitat used by denning female polar bears. These dens are widely and sparsely distributed over thousands of square kilometers of sea-ice habitat. The OCS drilling units and platforms and associated winter industrial activities would disturb only a very small number of female polar bears and cubs (probably less than six females) that happen to be denning within 1 or 2 kilometers of the platforms. Winter air traffic to and from support facilities and the platforms would not disturb other denning polar bears along the air-traffic routes because the noise would not be audible from inside the dens. Thus, only a few females and cubs are likely to be disturbed by the proposal. The possible loss of the few cubs due to disturbance of the females and subsequent abandonment of a few dens near the drilling units or platforms are not likely to represent a long-term effect on the polar population even in an equilibrium population (births equal to deaths). The polar bear population at "equilibrium" (there is no such thing as a true equilibrium population

in nature) will still vary naturally in recruitment (births) and in mortality (deaths) rates by more than the few polar bear cubs that may be lost due to disturbance associated with the proposal. In other words, the loss of a few polar bear cubs due to noise-human presence at or near the offshore exploration and production facilities would not represent a measurable effect (population loss) over and above the natural variation, even in an "equilibrium" population.

Response 5-16

Section III.D.5 has been amended to address this concern.

Response 5-17

This concern is addressed in Response 5-1.

Response 5-18

This concern is addressed in Response 5-1.

Response 5-19

The EIS is written to analyze the effects that the proposed action and the alternatives might have on the environment. The analyses of the proposed action are based on the mean-case resource estimates and corresponding hypothetical set of scenario conditions for exploration and development and production. The elements of the scenarios are based on the types of activities, facilities, and strategies that have been, or may be, used to exploit the petroleum resources in the Beaufort Sea and northern Alaska, other Arctic areas, and other marine environments.

The analyses of the deferral alternatives and the minimum and maximum cases are based on variations in the resources estimates and associated scenario conditions.

Response 5-20

The EIS has focused on the effects associated with the cumulative case, and the effect levels for the cumulative case were determined. In order to make this cumulative-case determination, it is necessary to also fully develop the proposed action and determine the level of effect associated with this action and the decision options.

Response 5-21

Conditional probabilities can only be used to estimate the probability of target contact if a spill occurred at a specific, hypothetical launch point (see also Response 5-3). Responses to specific points raised by the commenter follow:

* The conditional probability is not "risk" to a resource. Risk involves estimating the likelihood of spills occurring, of such spills contacting the habitat of that resource, and of what damage would occur to the resource if the habitat were contacted.

* Conditional probabilities cannot be used to estimate which targets are most likely to be contacted by spilled oil. Only combined probabilities provide this information. The highest conditional probabilities, greater than 99 percent, indicate only that the hypothetical spill point in question is within the target area. That is, the probability of a spill contacting the target area is high because the spill is assumed to have occurred within the target area. The EIS reviewer should place little emphasis on this obvious tautology.

* Seasonal conditional probabilities cannot determine the season that targets are most likely to be contacted by oil in the Beaufort Sea. About 79 percent of oil production and, therefore, spill risk would occur during the the 9.5 months of oceanographic winter. Obviously, any valid estimate of whether spills are more likely to contact a resource in summer than in winter would have to take into account that spills would occur with fourfold less frequency in summer than in winter. Combined probabilities, but not conditional probabilities, take this factor into account.

* Both combined and conditional probabilities are used to evaluate the relative merits of deferral alternatives in the EIS. Combined probabilities are used to estimate the likelihood of contact with spills, and conditional probabilities are used to verify the point of origin of such spills.

Response 5-22

This concern is addressed in Response 5-3.

Response 5-23

The approach used in the oil-spill-risk analysis for Sale 100 was developed specifically to handle a timeframe for ice-oil interactions that is unique to the northern Bering Sea. In the Beaufort Sea, the winter conditions persist longer, and a spill frozen into the ice in October could persist into summer. Seasonal probabilities would ignore this extra risk. The "open-water season" probabilities emphasized in the Sale 97 EIS include both winter spills that persist into summer and spills that occur in summer.

Response 5-24

This concern is addressed in Responses 5-3 and 5-21.

Response 5-25

The combined probabilities assess the likelihood of a spill occurring and contacting a resource target. The effects analyses in Sections IV.B through IV.I evaluate the potential effects of such contact on individual resources. Conditional probabilities provide no useful information on the level of effect that would occur if a spill contacted resource habitat, and the limited information contained in conditional probabilities about the likelihood of spill contact has already been used in the calculation of combined probabilities.

Response 5-26

Conditional probabilities can be used only to estimate the likelihood that, if a spill occurred at a specific location, it could contact specific areas of ocean or shoreline. An estimate of risk to a resource in that area of ocean or on that shoreline requires evaluation of whether the resource itself would be contacted and what damage such contact would cause. See also Responses 5-3 and 5-21.

Response 5-27

This concern is addressed in Response 21-39.

Response 5-28

This concern is addressed in Response 21-37.

Response 5-29

This concern is addressed in part in Response 21-38. Effects to multiple age classes are discussed in Section IV.B.2, with emphasis on the more abundant anadromous fishes. The importance of the coastal habitat to anadromous fishes was discussed in both Sections III.B.2 and IV.B.2.

Response 5-30

Although some of these effects are already discussed in Section IV.B.2, the discussion of sublethal effects has been expanded.

Response 5-31

The definitions of level of effect deal with two scales, temporal and spatial, both expressed in terms of populations. A MODERATE effect is not based on the assumption that only one year-class would be greatly reduced. Rather, it is predicated on a change in the distribution or abundance of a portion of a regional population that lasts for more than one generation. This could encompass effects to multiple age classes within a population.

Response 5-32

The potential effects of construction activities on fishes are discussed in Section IV.B.2. The commenter is also referred to Responses 21-49 and B-7. As detailed in Response 21-49, causeways are not expected to be built for Lease Sale 97.

Dredging activities that could affect the overwintering habitat of anadromous fishes (in freshwater channels and delta areas) would be regulated and permitted by the U.S. Army COE, EPA, and the State of Alaska. The duration of such activity is expected to be on the order of a few days or less for a particular site (see Response B-7). Since the projected landing points for Sale 97 offshore pipelines are Point Belcher (in the Chukchi Sea) and Oliktok

Point, little effect on overwintering habitat is expected. Because the potential effects of such activities are so site-specific, it is more appropriate to regulate and mitigate potential effects in the development and production phase.

Response 5-33

Section IV.B.5.b has been amended to address this concern.

Response 5-34

Section IV.I and Table II-C-1 have been amended to address this concern.

Response 5-35

Final reports from studies to assess the behavioral responses of bowhead whales to drilling activities and bowhead feeding in the eastern Alaskan Beaufort Sea will not be available in time to incorporate them in the FEIS. The study on the effects of drilling activities on bowhead whales will add some new data, but by looking at activities of two drillsites in a single year, the study will by no means provide definitive answers. The MMS believes that information regarding bowhead reactions to drillship noise collected in the Canadian Beaufort Sea and preliminary information regarding the bowhead migration past drillship operations in the Alaskan Beaufort Sea during 1986 is adequate to assess the potential effects on bowheads of drillship operations resulting from this lease sale. Furthermore, the final report on behavioral responses of bowhead whales to drilling activities should be available prior to the Secretary's decision on the lease sale. Likewise, the feeding study report should be available to the Secretary prior to the date of his decision on the lease sale.

Response 5-36

Although there have been few studies of offshore fishes in the Beaufort and Chukchi Seas, the available data suggest that these fishes are not very vulnerable to pronounced effects due to oil-related activities. The broad distributions of most of the species combined with the small area expected to be affected by a spill imply that only a portion of a population would be affected, hence the determination of a MINOR effect. More details are presented in Section IV.B.2.

Response 5-37

There is no conflict in conclusions between the ANWR LEIS conclusion on effects on polar bears and the 97 DEIS conclusion on polar bears. The definitions of a MODERATE effect level are different.

The concern about polar bear population equilibrium is addressed in Response 5-15.

Response 5-38

Deferral would reduce the risk of oil spills in the spring-migration corridor but would not eliminate it since oil may be transported through the area via ship or pipeline.

Response 5-39

The Barrow Deferral may not eliminate but would reduce (1) activity in the high-density seabird-feeding area near Point Barrow and (2) noise and disturbance effects in the Plover Islands and Peard Bay areas.

Response 5-40

This concern is addressed in Response 5-35.

Response 5-41

The Kaktovik Deferral would not eliminate but would reduce oil-spill risk and disturbance of birds and marine mammals from Kaktovik east to Demarcation Point; see Sections IV.F.3 and 4.

Response 5-42

The consideration stated was addressed in the DEIS in the assessment of potential effects to bowhead whales in Section IV.F.5.

Response 5-43

This concern is addressed in Responses 2-1, 6-2, 6-3, and 21-11.

Response 5-44

Section IV.F.5 addresses this concern. Since leases have already been granted adjacent to the proposed deferral area, aircraft and vessel traffic enroute to leased blocks through the deferral area could disturb bowhead whales. Also, oil spilled while being transported through the deferral area or spilled on adjacent leased blocks could affect bowhead whales within the deferral area.

Response 5-45

Section IV.B.14.a has been amended to address this concern.

Response 5-46

Changes in water temperature and salinity patterns are not predicted to result from activities associated with this lease sale; therefore, these types of changes are not discussed in relation to fish. Other potential changes identified (e.g., the discharge of drilling fluids) are discussed in Section IV.B.2.

Effects on water quality for the proposal are analyzed in Section IV.B.14.

Response 5-47

Section IV.B.14.a has been amended to address this concern.

Response 5-48

Section IV.B.14.a has been amended to address this concern.

Response 5-49

Section IV.B.14.a has been amended to address this concern.

Response 5-50

Section IV.B.14.a has been amended to address this concern.

Response 5-51

The "policy" is that of NEPA, not MMS. The conclusion on effects on water quality is based on what is expected to occur. A spill of 100,000 barrels or greater is not anticipated to occur as a result of Sale 97. The likelihood of contact with such a spill and what the effects of spill contact would be--for water quality or otherwise--are separately estimated in the EIS (Sec. IV). However, to base estimates of effects on a remotely possible, extreme event is contrary to NEPA requirements. The NEPA requires that extreme events of low probability, but possibly higher effect, be analyzed and that the probability of occurrence be stated--the resulting possible but unlikely effects must be stated but are not required to be factored into bottomline estimates of effects.

Response 5-52

Additional information on effects of dredging and gravel-island construction are provided in the incorporations by reference cited in Section IV.B.14. Further discussion of effects found to be NEGLIGIBLE is not warranted in the text.

Response 5-53

The empirical data discussed in Section IV.B.14 are for both muddy and sandy bottoms. This has been clarified in the text.

Response 5-54

The estimates of muds and cuttings used in Section IV.B.14.a are those provided in the Exploration and Development Report for Sale 97 (USDOI, 1985a,c; 1987) and are the same as those agreed to and used by EPA in their analysis of muds and cuttings in Appendix L.

Response 5-55

Both rates of discharge and total quantities of discharged muds and cuttings are discussed in Section IV.B.14.a. Discharges are short-term events. They last at most for a few hours, and with discharge plumes they are detectable

for no more than a few hours after discharge ceases. Therefore, effects on water quality are also short term, and rates of discharge are more important than the total quantities discharged over the life of the field. Note that discharges of muds and cuttings during field development are estimated to be less than an order-of-magnitude greater than for the exploration discharges, which EPA has already determined are not likely to exceed water-quality criteria at a distance of 100 meters or more from the discharge (Appendix L).

Response 5-56

A detailed discussion of the effects of muds and cuttings on water quality is contained in Appendix L. That information, plus information on expected total quantities discharged, maximum rates of discharge, existing legal limitations on discharge, and empirical studies of the results of discharge provide the basis for the analysis of effects of these discharges on water quality. Additional discussion of settling rates and grain size beyond that already contained in Appendix L and explicitly included in the discussed empirical studies in Section IV.B.14 is not warranted, particularly in view of the NEGLIGIBLE to MINOR effect of mud and cutting discharges on water quality.

The commenter is referred to Section IV.B.1 for an analysis of the effects of muds and cuttings on benthic biota.

Response 5-57

The Beaufort Sea General NPDES Permit applies only to exploration discharges of formation waters in the areas offered by past OCS sales. Sale 97 would be the first offering for part of the Sale 97 area. The EPA states in their next comment that no Ocean Discharge Criteria Evaluation (ODCE) has been done for production discharges and that such discharges would not be covered under any general NPDES permit. It would be premature to assume that EPA would prohibit formation-water discharges in less than 10 meters of water during production prior to their completion of an ODCE for that discharge.

Response 5-58

The effect on water quality of deliberate discharges during production is analyzed in Section IV.B.14.a. Adequate information on production discharges is available to assess potential effects on water quality; that EPA has not yet performed its ODCE process does not impair the analysis in the EIS.

Response 5-59

The EIS includes adequate information and analyses, based upon anticipated resources on equipment emissions, to demonstrate that the potential effects on air quality are MINOR. The necessary information is being assembled to use the Offshore and Coastal Dispersion (OCD) model for Alaska. However, the analysis in the EIS is more conservative (more pollutants) than OCD model results in that the analysis assumes constant onshore winds. The model, with variable winds, would demonstrate even less effect. Consequently, the results of the analysis, including consideration of existing emission-control measures, are adequate to support the conclusions.

Response 5-60

The OCD model results will likely be less conservative for the cumulative case (demonstrate less effects) than the analysis in the EIS text. The air-quality analyses made for prior Beaufort Sea lease sales also used the same conservative assumptions, which are that exploration, development, and production would be concentrated 5 kilometers from the shore and that winds would be constantly onshore. The addition of potential emissions from these analyses results in highly conservative emissions estimates for the cumulative case. In addition, the projected cumulative amount of oil resources for the U.S. Beaufort Sea is now less than either of the individual mean-case resources proposed for Sales 71 or 87. This effectively reduces emissions below previous cumulative-case estimates. Consequently, the air-quality analysis in the EIS for the cumulative-case effects is adequate to support the conclusion.

Response 5-61

Section IV.B.15.a(1) has been amended to address the concern with volatile organic compounds. Volatile organic compounds are a hydrocarbon component of photochemical pollution that forms primarily in periods of intense sunshine and can be trapped by atmospheric inversions and topography. In the Beaufort Sea, the winter months are completely dark. There is little topography, and winds interrupt the occasionally intense inversions. During the summer, inversions are less frequent and winds persist. Consequently, photochemical pollution is unlikely to form and linger. In addition, the projected emissions of volatile organic compounds could be reduced by 50 to 95 percent using existing control technologies. Although it is possible that remaining potential emissions could exceed the exemption level, it is very unlikely because this assumes that facilities will be clustered 5 kilometers offshore. It is very likely that facilities will be scattered and farther offshore. In any event--in order to ensure meeting air-quality standards at the shoreline--additional information and, if necessary, modeling and emission controls will be required of operators before they begin offshore activities.

Response 5-62

The information in the EIS uses available onshore (including shoreline) air-quality-monitoring information from analyses developed in support of Alaska Department of Environmental Conservation air-quality permits for the Prudhoe Bay area. Onshore air-quality monitoring is the purview of the EPA and the Alaska Department of Environmental Conservation. However, MMS would be willing to advise on monitoring station locations. The MMS collects offshore air-pollutant-emissions information from operators pursuant to Federal Regulations 30 CFR 250.34-3(a)(4), to the extent necessary to make air-quality-effects determinations under 30 CFR 250.57.

Response 5-63

The text in Section IV.H.14 has been corrected to eliminate the inconsistency. Because of an oversight, the word "MODERATE" should have been "MINOR" and has been changed accordingly.

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Response 5-64

Adequate information is presented in the EIS to demonstrate that the effects of burning oil spills and sulfate deposition on the tundra would not be long term. Based upon cited observations, it is demonstrated that the effects of soot from a burning oil spill would be short term, widely dispersed, and likely to be quickly diluted by precipitation, and therefore unlikely to harm the tundra. Sulfate deposition from emissions from offshore operations would be so widely scattered as to make a significant effect unlikely. In general, the increased air pollution from the proposal would be limited to the life of the oil field and would meet the air-quality standards that are designed to protect human health and long-term productivity.

Response 5-65

The text in Section IV.B.15 has been corrected to change "nitrous oxides" to "nitrogen oxides."

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MARINE MAMMAL COMMISSION
1625 EYE STREET, N.W.
WASHINGTON, DC 20006

6 January 1986

Mr. Alan D. Powers
Regional Director
Minerals Management Service, Alaska Region
U.S. Department of the Interior
949 East 36th Avenue
Anchorage, Alaska 99508-4302

Dear Mr. Powers:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the "Beaufort Sea Sale 97 Draft Environmental Impact Statement" and offers the following comments and recommendations.

GENERAL COMMENTS

The Draft Environmental Impact Statement (DEIS) provides an assessment of possible impacts from a proposed action to lease up to 3,930 blocks (approximately 8.58 million acres) of submerged OCS lands in the Beaufort and Chukchi Seas off the North Slope of Alaska for the purpose of oil and gas exploration and development. It also assesses the possible effects of six alternative actions and provides information on eight species of marine mammals likely to occur in the proposed sale area, including two species of endangered whales (i.e., bowhead and gray whales). It concludes that possible effects on endangered and non-endangered marine mammals as a result of the Proposed Action are likely to be minor and that cumulative effects of offshore oil and gas exploration and development on endangered whales are likely to be moderate. Consultations with the National Marine Fisheries Service, as required under section 7 of the Endangered Species Act, on the effects of the proposed action on endangered whales were initiated on 10 July 1985, but the results of those consultations were not available at the time that the DEIS was prepared.

The DEIS provides a reasonably thorough review of information on the abundance and distribution of marine mammals in the sale area and considers many, but not all possible impacts of the proposed action. It also provides information indicating that oil spills are not likely to occur and contact large numbers of endangered or non-endangered marine mammals and, in some cases, concludes or implies that the proposed action would therefore have a negligible or minor impact. While there may be a low probability of an oil spill occurring and directly affecting large

numbers of marine mammals, it does not necessarily follow that impacts which could occur would be minor. As discussed below, there are a number of uncertainties concerning potential effects of oil spills and disturbance which could result in impacts ranging from minor to major. Some potential impacts are difficult or impossible to identify or assess from available information and the Commission recommends that the FEIS acknowledge this and clearly indicate when possible impacts have been judged to be negligible or minor because of the low probability of occurrence. 6-1

With respect to potential impacts, the DEIS should be modified, as discussed below, to consider: a) the possible effects of garbage disposal practices from platforms on polar bears; b) the possibility that oil spills, disturbance, etc. will cause walrus, polar bears, ice seals or other species to move to adjacent and already occupied areas increasing animal densities in those areas to levels which will damage or deplete food supplies; and c) the possible cumulative effects of subsistence harvesting and other activities, as well as oil and gas exploration and development on bowhead and beluga whales, polar bears, walrus, and seals.

The DEIS also identifies a number of potential mitigating measures including: stipulations for an orientation program, the protection of biological resources, and seasonal drilling restrictions for protection of bowhead whales; and "information to lessees" notices on bird and marine mammal protection, areas of special biological and cultural sensitivity, the Beaufort Sea Biological Task Force, subsistence whaling and other subsistence activities, and endangered whales. These measures would help reduce potential impacts associated with the proposed lease sale and the Commission recommends that they be incorporated with the modifications discussed below as part of the proposed and alternative leasing actions.

Because of the uncertainties noted above and discussed below, the Commission also recommends that the Minerals Management Service consider the possible utility of developing and implementing monitoring programs aimed at detecting possible unforeseen impacts before these impacts can reach unacceptable levels. Some potential impacts, as noted earlier, are difficult or impossible to identify and assess using available information. In some cases, it could be excessively costly and time consuming, if not impossible, to obtain the information required for accurate impact assessment prior to initiating exploration and development. Such situations could lead to adverse environmental impacts, and/or delay exploration and development, and might be avoided at least in part by developing and implementing monitoring programs to identify possible unforeseen impacts in time to take remedial steps to assure that they do not reach unacceptable levels. 6-2

SPECIFIC COMMENTS

<u>Pages I-1 to I-5, Leasing Process:</u> This section identifies the steps considered as part of the leasing process for the proposed sale. Step number 6 ("preparation of Draft Environmental Impact Statement") notes the importance of the Minerals Management Service's Alaska Environmental Studies Program with respect to the preparation of the DEIS and refers the reader to a description of that Program in Appendix D. The Environmental Studies Program also is an important source of information for other identified steps in the leasing process and, to appropriately identify its role, either the section should be expanded to list and describe the role of the Environmental Studies Program as a separate step, or its role should be discussed under each of the other relevant steps already described (e.g., the leasing schedule, area identification, scoping, endangered species consultations, etc.). 6-3

<u>Pages II-12 to II-26, Potential Mitigating Measures:</u> This section identifies a number of "potential stipulations" and "information to lessees" notices which are intended to reduce potential impacts on various resources including marine mammals. The potential stipulations include, among others, measures for: an orientation program; protection of biological resources; and seasonal drilling restrictions to protect bowhead whales. The Notices to lessees include, among others, those which provide information on: bird and marine mammal protection; areas of special biological sensitivity; the Beaufort Sea Biological Task Force; subsistence whaling; and endangered species. Such measures would help to avoid or reduce potential impacts on marine mammals and the ecosystems of which they are a part and the Commission recommends that they be modified as discussed below and incorporated as part of the Proposed Action and other leasing alternatives.

One of the most important steps that can be taken to ensure that the environment and other resources are not adversely affected is to ensure that the lease manager (the Regional Supervisor, Field Operations) has the information necessary to make informed decisions with respect to the possible effects of lease operations. This need is identified in section 20 of the Outer Continental Shelf Lands Act, which requires the Secretary of the Interior to conduct environmental studies, including post-lease sale monitoring studies as may be necessary to obtain information pertinent to sound leasing decisions and for the purpose of identifying significant post-lease sale changes in environmental conditions. Specific research and monitoring needs are also identified in the Biological Opinion prepared by the National Marine Fisheries Service and included in Appendix J of the DEIS.

The Minerals Management Service's Regional Environmental Studies Program, which addresses these requirements and needs, has provided and should continue to provide information essential for predicting, detecting and mitigating potential environmental impacts. If such a program were not in place for the sale area 6-3

during the period of post sale activity, the likelihood of detecting and correctly attributing causes to unforeseen environmental effects, particularly long-term incremental impacts that are difficult to predict, will be significantly reduced. Although certain possible monitoring activities are identified with respect to potential stipulations and "information to lessees" notices identified in this section of the DEIS, a management related monitoring and studies program is not identified as a required or potential mitigating measure here or elsewhere in the DEIS.

The Commission, therefore, recommends that this section of the DEIS or the preceding section entitled "Mitigating Measures That Are Part of the Proposed Action" be expanded to identify and describe the roles of the Service's Alaska Environmental Studies Program and the lessee during the post-lease sale period in ensuring that lease managers are able to detect and mitigate possible unforeseen effects. In this regard, the DEIS should identify the steps that will be taken to ensure that the requisite monitoring program is identified and in place during the course of field development and production.

<u>Pages II-16 to II-19, Stipulation No. 4, Seasonal Drilling Restriction for Protection of Bowhead Whales from Potential Effects of Oil Spills:</u> This Stipulation would minimize possible effects of disturbance, noise, and drilling muds as well as oil spills on bowhead whales. We therefore suggest deleting the words "from the Potential Effects of Oil Spills" from the title. 6-4

<u>Pages II-20 to II-22, Information on Bird and Marine Mammal Protection:</u> This section of the DEIS provides information on requirements and guidelines for protecting certain wildlife resources. The second sentence of the fourth complete paragraph on page II-21 refers to "Notice to Lessees No. 84-3," which specifies performance standards to be followed during the conduct of preliminary activities on a lease. We are not familiar with the terms of this Notice and request that a copy of this and other Notices related to marine mammals be sent to us. In addition, if it is not already included in either this Notice or the Orientation Program required under Potential Stipulation No. 2, provisions should be made to advise oil industry personnel and their contractors of the penalties as well as the performance standards associated with laws pertaining to bird and marine mammal protection. 6-5

<u>Page II-22, Information on Areas of Special Biological and Cultural Sensitivity:</u> This Notice advises lessees of certain areas of special biological sensitivity. If it has not already been done, the Commission recommends that the Minerals Management Service consult with the Fish and Wildlife Service and the National Marine Fisheries Service to ensure that all areas of special biological importance to polar bears, seals, and beluga whales have been identified and included on the list in this 6-6

Notice. The Notice should also be expanded to note that these areas should be targeted for special measures to minimize or restrict possible disturbance associated with noise and construction activities.

Pages II-24 to II-25, Information on Subsistence Whaling and Other Subsistence Activities: This Notice advises lessees of the location and timing of subsistence whaling activities along Alaska's North Slope. It should be expanded to provide similar information concerning the subsistence take of polar bears, beluga whales, bearded seals, and other species of importance to Alaska Natives. 6-7

Pages III-24 to III-27, Pinnipeds, Polar Bears, and Beluga Whales: This section provides a useful review of information regarding population size, distribution, and reproductive patterns of certain marine mammals which occur in the leasing area. To indicate the relationships among these and other components of the Beaufort Sea food web, it would be useful to include a schematic diagram of the principle components of the food web. 6-8

Page IV-B-34, fourth paragraph: The marine mammal population estimates cited in the first sentence of this paragraph appear to be for all of Alaska rather than for the proposed sale area in which the species "commonly occur year-round or seasonally." 6-9

Page IV-B-35, second complete paragraph: This one sentence paragraph states that a study of oil effects on dolphins provides "sufficient insight" on potential effects of oil spill contact on beluga whales. Transferring the results of studies on one species to another species is subject to great uncertainty. It therefore is questionable whether the insight is sufficient and the word "sufficient" probably should be deleted. 6-10

Page IV-B-36, second complete paragraph: This paragraph notes that ringed, spotted and bearded seals, walrus and beluga whale are capable of moving from an area of local prey depletion resulting from an oil spill to other unaffected locations where prey are abundant. While the capability no doubt exists, the DEIS fails to consider what would happen if the unaffected areas already were inhabited and the influx of additional animals resulted in densities above carrying capacity and depletion of food supplies in those areas as well. It should be noted that such a shift in species distribution could stress remaining food resources and result in a general decrease in carrying capacity which could precipitate a regional population decline. 6-11

Page IV-B-37, third complete paragraph: This paragraph concludes that the one time loss of 20-30 polar bears due to an oil spill is likely to represent a minor impact. If polar bear populations are declining or stabilized at low levels because of subsistence hunting or other sources of mortality, the loss of this number of bears, particularly if all or most were females, could have more 6-12

than a minor effect. The paragraph should be revised to better reflect the potential range of impacts on polar bears.

Page IV-B-38, Effects of Noise and Disturbance: This section should be expanded to note that disturbance of seals, polar bears, and beluga whales by exploration and development activities could result in site avoidance by individuals of one or more species. As noted above, this could, in turn, result in increased pressure on limited food resources in those areas into which displaced animals move. For this reason, it should be noted that potential impacts on polar bears and perhaps beluga whales and seals could range from negligible to moderate rather than minor. 6-13

Page IV-B-42, Effects of Offshore Construction: This section discusses the effects of constructing offshore drilling platforms. Food scraps and other trash generated by workers during construction, as well as operation of these platforms, could attract polar bears. Such attraction could result both in death or injury of workmen and in some bears being shot as nuisance animals. This section should be expanded to discuss these potential effects. 6-14

Pages IV-B-43 to IV-B-44, carryover paragraph: The sentence beginning on the bottom of page IV-B-43 notes that in the event of a severe oil spill, contamination of benthic food sources and feeding habitats could reduce winter survival of walrus the following year and possibly reduce herd productivity for that year. It should be noted that these effects could be manifested for more than one year or until the food resources recovered to the pre-spill state. 6-15

Pages IV-B-44, first and second complete paragraphs: These paragraphs note that noise and disturbance from aircraft and ship traffic servicing drilling platforms could greatly disturb hauled out seals and walrus causing them to charge into the water, that vessel traffic associated with supply boats and icebreakers could temporarily displace or interfere with marine mammal migration and distribution for a few hours to a few days, and that these effects are likely to be minor. The paragraphs should be expanded to note that repeated occurrences of such events could lead to area avoidance by some or all of these species and that the significance of such avoidance could range from negligible to major. 6-16

Page IV-B-44, Conclusions: For reasons noted above, something like the following should be added to the end of the sentence: "...however, potential impacts could range from negligible to major." 6-17

Page IV-B-44 to IV-B-47, Cumulative Effects: This section should be expanded to consider the effects of subsistence hunting on the abundance and distribution of polar bears, beluga whales, bearded seals, and ringed seals. In addition, for the reasons already noted, the conclusion on page IV-B-45 should be revised to 6-18 indicate that possible cumulative effects are uncertain for these species and they could range from negligible to major.

Page IV-B-48, first paragraph: This paragraph notes that, if bowhead whale habitat is contaminated with spilled oil, there could be a localized reduction in food resources and perhaps a temporary displacement from feeding areas. It should be noted that "a localized reduction in food resources" could have a significant adverse effect if alternative food resources are not readily available or if reduction in one area results in higher predator pressure in other areas. In addition, it should be noted that oil contamination of an important feeding area could induce a long-term avoidance of such an area by bowhead whales. 6-19

The last sentence of the paragraph, which notes that no drilling or nondrilling blowouts greater than 1000 barrels occurred during the period from 1981 to 1983, should be expanded to note that the vast majority of this experience is based on wells drilled in less rigorous non-Arctic environments. 6-20

Page IV-B-49, second complete paragraph: This paragraph notes that it has been suggested that ingested oil may coat the stomach or intestinal mucosa of a bowhead whale, but that "since cetaceans do not drink sea water, it is unlikely that bowheads would ingest the quantity of oil needed to produce toxic effects." The fact that cetaceans do not drink sea water does not preclude the possibility that oil might be ingested incidental to feeding activity. The sentence should be revised to better reflect the likelihood of oil ingestion. 6-21

Pages IV-B-49 to IV-B-50, carryover paragraph: The last sentence of the paragraph notes that "...bowhead whales may be capable of metabolizing and and (sic) excreting polynuclear aromatic hydrocarbons from oil, so it is unlikely that petroleum hydrocarbons would accumulate to harmful levels...". The conclusion does not follow from its premise. The end of the sentence should be changed to read something like "so it is possible that petroleum hydrocarbons might not accumulate to harmful levels...". 6-22

Page IV-B-50, second complete paragraph: Data or reference(s) should be provided to support the conclusion in the third sentence which states that "(d)ischarges of fluids from drilling units and production platforms should not significantly decrease bowhead whale food resources." 6-23

Page IV-B-54, Summary and Conclusion Paragraphs: For reasons noted above, this paragraph should be expanded to note that a "localized" reduction in food resources could have a significant impact, and that it is uncertain whether or not an oil spill in a critical feeding area could result in significant long-term site avoidance by bowhead whales. It should be noted that while the expected impacts on bowhead whales would be minor, the actual impacts could range from negligible to major. 6-24

Page IV-B-54 to IV-B-56, Cumulative Effects: This section discusses cumulative effects of offshore oil and gas activities on bowhead whales. It should be expanded to indicate the possible cumulative effects of subsistence hunting and other human activities as well. If all potential impact sources are considered, the possible cumulative effects on bowhead whales might well be major. 6-25

I hope these comments and recommendations are helpful. If you or your staff have any questions concerning them, please let me know.

Sincerely,

Robert J. Hofman, Ph.D.
Scientific Program Director

cc William D. Bettenberg

Response 6-1

This concern is addressed in Response 21-23.

Response 6-2

MMS has implemented monitoring studies of marine mammals and of trace-metal and hydrocarbon levels in the Beaufort Sea. Further information on the Environmental Studies Program, including monitoring studies, has been added to Appendix D.

Response 6-3

Further discussion of the postlease role of the Environmental Studies Program has been added to Appendix D.

Response 6-4

The MMS agrees with your assessment that the effects of disturbance, noise, and drilling muds on bowhead whales would also be minimized; however, the major concern for which this measure was developed was oil spills. Since we have another mitigating measure for noise effects, we believe the title should remain unchanged.

Response 6-5

Because it is intended for individuals, the Orientation Program should emphasize the positive aspects of informing industry personnel about the biological resources and the community values, customs, and lifestyles of the people in the areas where exploration and development and production activities may occur. The program should not focus on the negative aspects (penalties) of failure to comply with the laws.

The MMS cooperates with those agencies that are responsible for enforcing laws to protect birds and marine mammals but reasonably should not be expected to inform the lessees and their contractors of all applicable performance standards that these agencies have.

Response 6-6

FWS and NMFS, along with other public agencies and private organizations, have the opportunity to contribute information about important biological habitats during (1) the scoping process--Section I.A.5, (2) the review and public hearings on the DEIS--Section I.A.8, and (3) MMS-sponsored Information Update Meetings and Information Transfer Meetings--Section I.A.6.

Also, see Responses 2-15 and 7-7.

Response 6-7

ITL No. 5, Information on Subsistence Whaling and Other Subsistence Activities, focuses on bowhead whaling because of the bowheads' extreme importance to North Slope subsistence and way of life. However, ITL No. 5 does not

ignore the importance of other subsistence activities. It states, "Lessees are therefore advised that operations should be conducted so as to avoid unnecessary interference with subsistence harvests."

Response 6-8

A schematic diagram of the principal components of the food web is presented in Graphic 2. A reference to this food web has been added to the pinniped, polar bear, and beluga whale discussion in Section III.B.4.

Response 6-9

As noted in Section IV.B.4, the population numbers for the six species of nonendangered marine mammals are estimates of the animals that commonly occur year-round or seasonally throughout or in a part of the Beaufort Sea Planning Area. The planning area includes marine mammal habitats of both the Beaufort and Chukchi Seas.

Response 6-10

Extrapolating the results of studies on one species to another is not always subject to great uncertainty. Beluga whales, dolphins, and porpoises are closely related cetacean species. The effects of oil contact on dolphins are applicable to beluga whales.

Response 6-11

The area affected by an oil spill--for example, the under-ice habitat of ringed seals--would be no more than a few square kilometers, even in a severe case, and contamination would involve the displacement of no more than a few seals. This level of displacement would have no effect on the overall seal populations, even in a relatively local area such as Camden Bay. The influx of a few additional seals into unaffected adjacent habitats would not be over and above the natural variation in abundance of seals in the unaffected habitat. Thus, carrying capacity would not be measurably decreased. No measurable shifts in marine mammal-species distribution are likely to occur as a result of an oil spill. The area that would be severely affected or contaminated by an oil spill to the point of causing a food shortage for marine mammals would be very small, and the effect on food-organism numbers would be very temporary (a few days) because of the rapid recruitment of fish and invertebrates from adjacent areas.

Response 6-12

The assertion that all or most of the polar bears killed by one or more spills would be females is an unreasonable assumption even for a worst-case analysis, if it were required. For one or more spills to selectively contact a group of polar bears consisting predominantly of females, the spills would have to occur and contact an area of female denning-concentration sites at the time the bears are leaving the den. Female bears leave the dens in March or April when the spilled oil would still be frozen under or in the ice. Furthermore, there is no evidence that polar bear populations are declining or are at low levels.

MMS is required to determine the effect level of the proposal, not to repeat the full range of possible effects on the resource (NEGLIGIBLE to MAJOR).

Response 6-13

Site avoidance by marine mammals as a result of exploration and development and production activities such as air and vessel traffic would be very short term, lasting a few minutes to no more than a few days (a MINOR effect). The length of displacement would not significantly (measurably) affect the food sources of the displaced animals or food sources of other marine mammals in adjacent areas; therefore, no long-term effects would be expected. Additionally, there has been no documented or observed long-term (several months-years) site avoidance of production facilities by marine mammals in association with oil exploration and development in other areas such as Cook Inlet, Alaska.

See Response 6-12 in regard to the use of effect-level ranges.

Response 6-14

MMS Operating Order No. 7, Pollution Prevention and Control, prohibits the dumping of food scraps and trash that would attract polar bears to the platforms. Although some bears are still attracted to industrial facilities, the number of bears sacrificed due to safety reasons would be NEGLIGIBLE to the population. The Marine Mammal Protection Act of 1972 prevents the taking of polar bears (as defined in the act) by the oil industry in regard to industry operations in the Beaufort Sea without special permits from FWS. The taking of polar bears by other industrial or commercial activities is also prohibited under the Marine Mammal Protection Act. The use of harmless deterrents such as plastic bullets or other measures to avoid interactions and/or encounters between oil workers and bears can be successful.

Response 6-15

Even in a very large oil-spill event, the amount of oil reaching the benthic-feeding habitat of walruses and affecting the clam population would be only a small fraction of the total oil spilled. Thus, the amount of benthic habitat (perhaps a few km^2) and number of benthic organisms are likely to be small in comparison to the size of walrus-feeding areas (several hundred to several thousand km^2). The remixing and suspending of benthic sediments due to storms and ice scour would disperse the oil in contaminated sediments. Following removal of the oil and contaminated sediments, other benthic fauna would recolonize the areas previously contaminated by the spill within 1 year. Thus, effects on walrus-food sources would not likely persist for more than 1 year. The effect of spilled oil on benthic-organism communities is likely to be MINOR; see Section IV.B.1.a(1)(c).

Also, see Response W-3.

Response 6-16

"Repeated disturbance" of hauled-out walruses and seals along the pack-ice front by aircraft traffic would not result in long-term or seasonal avoidance of the ice front. In the first place, the locations of the ice front and the

walruses change constantly from day to day. Even if each aircraft flight during exploration and development were to disturb some walruses and seals, each incident would disturb different animals on different ice floes. There is no evidence that repeated exposure of seals-pinnipeds to aircraft traffic at an onshore-haulout location causes abandonment of the habitat. Even the killing of seals from airplanes on Tugidak Island in the Gulf of Alaska prior to the enactment of the 1972 Marine Mammal Protection Act did not cause the animals to abandon pupping and haulout sites on the island. Marine mammals do not readily abandon habitat areas, even when they are subject to such severe harassment as the killing of large numbers of individuals of the species.

Response 6-17

This concern is addressed in Responses 6-12 and 6-16.

Response 6-18

The major projects considered in the cumulative-effects assessment of polar bears, pinnipeds, and beluga whales are shown in Table IV-A-7. The effects that subsistence hunting may have on the abundance and distribution of marine mammals are more appropriately assessed by those Federal agencies, such as FWS and NMFS, and State agencies, such as the Alaska Department of Fish and Game, that are charged with management responsibilities for these species.

Also, see Response 6-12.

Response 6-19

The MMS does not believe that a localized reduction in food resources would significantly affect bowhead whales. Perhaps there is some confusion from the lack of quantification associated with the term "localized reduction." As stated in Section IV.B.5.b(1), even a large spill of 10,000 barrels under open-water conditions is predicted to produce a slick which, after 10 days, would cover only 1 to 2 square kilometers of surface area. Therefore, we are talking about an extremely small, localized area. The highest crude oil water-soluble-fraction (WSF) concentration observed in experimental situations or predicted by spill dissolution models was 0.6 parts per million (Thorsteinson, 1984). In experimental tests of crude oil WSF on the euphausiid Thysanoessa raschii, a major prey item of bowhead whales, Fishman, Caldwell, and Vogel (1985) generally found that a WSF concentration of 0.6 parts per million would have no effect on most lifestages of the euphausiid and that population losses would be minimal, if any. This information combined with the fact that bowhead-food sources are very patchy and transitory leads us to conclude that an oil spill would not have significant adverse effects on the bowhead whale's food resources.

We are unaware of evidence that would indicate that bowhead whales would display long-term avoidance of important feeding areas into which oil is spilled. On the contrary, Goodale, Hyman, and Winn (1981) report that humpback whales, fin whales, and possibly right whales were actively feeding and surfacing in and near slicks from the Regal Sword oil spill, and gray whales migrate semiannually through waters contaminated by natural oil seeps off the California coast.

Response 6-20

Section IV.B.5.b(1) has been amended to address this concern.

Response 6-21

Section IV.B.5.b(1) has been amended to address this concern.

Response 6-22

Section IV.B.5.b(1) has been amended to address this concern.

Response 6-23

Section IV.B.5.b(1) has been amended to address this concern.

Response 6-24

This concern is addressed in Response 6-19. Based on that information, we do not believe a change is needed in Section IV.B.5.b(1).

Response 6-25

An analysis of the effects of the proposed action on the subsistence uses of bowhead whales is in Section IV.B.9. Cumulative effects are discussed in Section IV.B.9.b(3).

7

STATE OF ALASKA

STEVE COWPER, GOVERNOR

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January 5, 1987

RECEIVED
JAN 9 1987
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Mr. Alan D. Powers
Regional Manager
Alaska OCS Region
Minerals Management Service
P.O. Box 1159
Anchorage, AK 99510

Dear Mr. Powers:

The State of Alaska appreciates the opportunity to review the Department of the Interior's (DOI) Draft Environmental Impact Statement (DEIS) for the Beaufort Sea Outer Continental Shelf (OCS) Sale 97 planning area. Our comments focus on four aspects of the DEIS including: (1) the proposed action and alternatives, (2) the Section 810 evaluation, (3) the proposed mitigating measures, and (4) the environmental impact assessment. Each of these topics are discussed below.

Proposed Action and Alternatives

The DOI is proposing to offer for lease 3,930 blocks or approximately 21.2 million acres (Alternative I) in the Beaufort and Chukchi seas. The state recommends that the DOI adopt the Barrow Deferral Alternative IV which would defer 201 whole or partial blocks located offshore from Point Barrow. The state will defer making any recommendations on the Kaktovik Deferral (Alternative V) until we have had an opportunity to review and consider the results of various studies addressing bowhead whales in this area. Both of these deferral alternatives are discussed below.

The Barrow Deferral recommendation is consistent with past state policy and could significantly reduce potential impacts to subsistence harvest activities, marine mammals, and waterfowl. The state supported a similar but larger deferral in OCS Sale 87, and recently reemphasized its support for deferrals around Point Barrow in its May 8, 1986, comments on the draft proposed five-year OCS leasing program. The Barrow Deferral would also remove the Chukchi polynya from the sale area which could significantly reduce potential impacts to marine mammals and waterbirds. The Chukchi polynya is an open-water ice lead system

that occurs along the eastern shore of the Chukchi Sea. The polynya is formed when prevailing winter and spring easterly winds move the ice pack away from shorefast ice. This tends to maintain an open ice lead system from January onward. The lead system is extremely important to marine mammals and seaducks, particularly bowhead whales and king eiders, as a spring migration corridor. Oilspills in this lead system could severly impact these species. Noise and disturbance caused by industrial activities in this area could also have the potential to disrupt the spring migration of bowhead whales because they would be restricted to the ice lead system.

The state prefers the use of mitigating measures in lieu of deferrals whenever scientific information and technological capabilities enables leasing to proceed in an environmentally sound manner. In the case of the area around Barrow, however, several questions remain which need to be addressed before leasing should occur. The state recommends that leasing be deferred in the vicinity of Barrow for at least another two years in order to: 1) obtain additional information regarding the effects of industry-related noise and disturbance on subsistence whaling activity and marine mammals, including bowhead whales; 2) allow the oil industry to gain additional experience in operating in multi-year ice conditions found in the vicinity of Barrow; and 3) allow time to determine whether appropriate mitigation measures for protecting the wildlife resources in the Chukchi polynya can be developed.

Several studies are currently ongoing which the state would like to review prior to developing a recommendation on the Kaktovik Deferral. A key study entitled "Food Organisms of Bowhead Whales in the Eastern Beaufort Sea" is examining the importance of the eastern Beaufort Sea as feeding grounds for bowhead whales. A similar study entitled "Zooplankton of a Bowhead Whale Feeding Area of the Yukon Coast" is being sponsored by the Canadian Government which will provide information on habitats to the east of Demarcation Point. The DOI is also sponsoring a study entitled "Prediction of Drilling Site-Specific Interaction of Industrial Acoustic Stimuli and Endangered Whales: Beaufort Sea" which will provide additional data on potential disturbance effects to bowhead whales. All of these are two-year studies with the final reports to be available in the Spring of 1987. Shell Western E&P Inc., and Union Oil Co., both monitored their drilling activities this past summer to assess the potential disturbance of drilling and support activities to migrating bowhead whales. Preliminary drafts of these results will also be available by March 1987. These studies should provide important information to assessing the effects of oil and gas exploration, development, and production on bowhead whales. The state anticipates developing a recommendation on the Kaktovik Deferral for the Proposed Notice of Sale after reviewing the aforementioned studies.

In addition to our specific deferral request, there are a number of areas that are being identified at this time in which both the state and federal government claim ownership. Some of these areas are the subject of litigation. The state is considering the feasibility of an interim agreement with Minerals Management Service (MMS) for oil and gas leasing purposes. If agreement is not reached, the state may request deletion of certain disputed acreage.

Section 810 Evaluation

The DEIS includes a thorough discussion of subsistence uses of fish and wildlife resources by North Slope communities. Likewise, the Section 810 evaluation of potential impacts on subsistence uses is reasonable and logically consistent. It incorporates many of the recommendations we have made to federal agencies regarding the composition of adequate 810 evaluations, including a community approach, and relatively detailed information on subsistence harvest activities. The 810 evaluation concludes that Sale 97 may result in significant restrictions on subsistence uses of bowhead whales and waterfowl in Barrow, Atquasuk, and Nuiqsut; of bowhead and belukha whales and waterfowl in Kaktovik; and of bowhead and belukha whales, seals, and caribou in Wainwright.

However, the state has two remaining concerns with the Section 810 analysis. First, it does not discuss to what degree the potential "significant subsistence use restrictions" predicted in the section would actually effect the social and economic structure of the affected communities. There currently is no way 7-1
to determine from the 810 analysis how significant these projected restrictions may be to residents of the North Slope. Some type of quantification and/or assessment would appear to be essential to the development of alternatives on mitigation.
Second, it fails to adequately address Section 810(a)(3)(C), which requires that "reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such action." While the evaluation lists some of the types 7-2
of mitigating measures available, it does not provide any specific plan for assuring that the projected adverse impacts will be minimized.

We believe that Section 810(a)(3)(C) requires a process through which local residents knowledgeable about local subsistence patterns are closely involved in identifying specific problems and working out mitigating solutions. Residents of North Slope 7-3
villages actively involved in hunting and fishing have the most knowledge of specific local subsistence patterns. Systematically involving them in the mitigation process would help meet the

requirements of Section 810(a)(3) as well as help ensure the meaningful role for local rural residents envisioned by Congress in the Alaska National Interest Lands Conservation Act (ANILCA) Title VIII.

Proposed Mitigating Measures

The state supports the adoption of all the proposed stipulations and Information to Lessees (ITLs) contained in the DEIS and think they will contribute to the necessary protection for fish and wildlife resources in the proposed sale area. In addition, the state recommends (1) changes to the language of proposed Stipulation 3 regarding protection of biological resources, (2) the adoption of a stipulation regarding testing of oilspill containment equipment, (3) the adoption of Stipulation No. 7 from Sale 87 regarding discharges of produced waters, drilling muds, and cuttings, and (4) modification of ITL No. 2 to ensure lessees take appropriate protective measures in their oilspill contingency plans to protect the biologically sensitive Colville Delta and coastal salt marshes from Kogru Inlet to the west side of Smith Bay. Enclosure 1 contains specific stipulation language recommended for inclusion of mitigating measures for Sale 97.

Environmental Impact Assessment

The state has three major concerns regarding the DEIS analysis of potential environmental impacts, including: (1) DOI's approach to discounting impacts to local populations as well as discounting benefits from various deferral alternatives by evaluating them on a regionwide basis, (2) the failure to include specific discussions or conclusions on the effects of oilspills and noise disturbance on marine mammals and birds in the Chukchi spring lead system, and (3) the DEIS's general discounting of potential oil and gas development impacts to bowhead whales. Each of these concerns are discussed in Enclosure 2.

Please call if you have any questions regarding the state's comments.

Sincerely,

Robert L. Grogan
Director

Enclosures

cc: Commissioner Don Collinsworth, DFG, Juneau
Commissioner Judy Brady, DNR, Juneau
Commissioner Dennis Kelso, DEC, Juneau
Mayor George Ahmaogak, North Slope Borough, Barrow
John Katz, Office of the Governor, Washington, DC
Rod Swope, Office of the Governor, Juneau

ENCLOSURE 1

Recommended Stipulations and Information to Lessee for the Diapir Field OCS Lease Sale 97

The state supports the proposed mitigating measures contained in the Draft Environmental Impact Statement (DEIS). The following changes or additional measures are also recommended as being necessary to adequately protect the fish and wildlife resources in the Beaufort Sea planning area.

Stipulation 3 - Protection of Biological Resources

The state recommends that the wording of Stipulation 3 be revised as follows:

a. If the RSFO has reason to believe that biological populations or habitats exist and require protection, the RSFO shall give the lessee notice that the lessor is invoking the provisions of this stipulation and the lessee shall comply with the following requirements. Prior to any drilling activity or the construction or placement of any structure for exploration or well drilling and pipeline and platform placement, hereinafter referred to as "operation," the lessee shall conduct site specific surveys as approved by the RSFO in accordance with prescribed biological survey requirements to determine the existence of any special biological resource including but not limited to: 7-4

1. Very unusual, rare or uncommon ecosystems or ecotones; or

2. A species of limited regional distribution that may be adversely affected by any lease operation.

If the results of such surveys suggest the existence of a special biological resource that may be adversely affected by any lease operation, the lessee shall: (1) relocate the site of such operation so as not to adversely affect the resources identified; (2) modify operations in such a way as not to adversely affect significant biological populations or habitats deserving protection, or (3) establish to the satisfaction of the RSFO, on the basis of the site specific survey, either that such operations will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist. The RSFO will review all data submitted and determine, in writing, whether a special biological resource exists and whether it may be significantly affected by the lessee's operation. The lessee may take no action until the RSFO has given the lessee written directions on how to proceed.

b. The lessee agrees that, if any area of biological significance should be discovered during the conduct of any operations on the leased area, the lessee shall immediately report such findings to the RSFO and make every reasonable effort to preserve and protect the biological resources from damage until the RSFO has given the lessee directions with respect to its protection.

The primary advantages from modifying Stipulation 3 would be: (1) it would not be confined to those resources contained in the lease area; (2) the Regional Supervisor of Field Operations (RSFO) would be required to determine, in writing, whether a special biological resource exists and whether it may be significantly affected, versus no requirements for written determinations, and (3) the stipulation would be invoked when resources "require protection," versus when resources "may require additional protection." If adopted, the above language would provide increased protection to the fish and wildlife resources of the proposed sale area.

Stipulation 4 - Seasonal Drilling Restriction for Protection of Bowhead Whales from Potential Effects of Oilspills and Noise

As you are aware, during 1986 the state conducted an extensive review of the seasonal drilling restrictions in the Beaufort Sea. The state's review, based on available information, culminated in a state policy to allow drilling activities from floating platforms to occur during a portion of the bowhead whale migration if an approved research program was conducted. The purpose of the research program was to obtain needed information on the affects of drilling noise and support activities on migrating bowhead whales, and on subsistence whale hunting activity. The state policy allows drilling activities from bottom-founded structures to occur year-round and, depending on the location, lessees may be required to conduct an approved research program.

Although a limited amount of information was acquired from monitoring efforts conducted this summer, we will defer making any recommendations on this stipulation until the results of those studies are available for review.

Recommended Stipulation 6 - Testing of Oilspill Containment Equipment

The state is concerned about industry's capability to cleanup oilspills under conditions characteristic of the Beaufort Sea. The stipulation recommended below is designed to improve a lessee's oilspill response capability by requiring semiannual full-scale drills and frequent inspection of response equipment to assure readiness. Consequently, we recommend that the Testing of Oilspill Containment Equipment Stipulation, as presented below, be included in the Sale 97 Notice of Sale (NOS).

"The lessee shall conduct semiannual full-scale drills at the request of the lessor for platforms and operator-controlled contracted cleanup vessels to test the equipment and the contingency plan. These drills must involve deployment of all primary equipment identified in the oilspill contingency plans as satisfying OCS Order No. 7. At least two of these drills shall include the primary equipment controlled and operated by the appropriate cooperative. These drills will be unannounced and held under realistic environmental conditions in which deployment and operations can be accomplished without endangering safety of personnel. Representatives of the U.S. Coast Guard, Minerals Management Service, and State of Alaska may be present as observers. The lessor's inspectors will frequently inspect oil and gas facilities where oilspill containment and cleanup equipment are maintained in order to assure readiness." 7-5

This stipulation would increase the assurance for adequate oilspill response capability currently provided by Alaska OCS Operating Orders Nos. 2 and 7 in five ways. First, this stipulation requires semiannual drills, while Operating Order No. 7 requires annual drills. Secondly, drills under the stipulation are unannounced by the lessor, while Operating Order No. 7 allows drills to be scheduled by the lessee. Third, the stipulation requires at least two drills to involve primary equipment controlled and cperated by the cooperative, versus the requirement for only on-site equipment under Operating Order No. 7. Fourth, the stipulation directs that drills be held under realistic environmental conditions without endangering the safety of personnel, where as Operating Order No. 7 states that drills shall be realistic. For example, some drills held for St. George Basin Sale 70 leases, to satisfy Operating Order No. 7, have been conducted in Captains Bay outside of Dutch Harbor. Such conditions do not approximate realistic environmental conditions present in the St. George Basin. Finally, the stipulation requires the lessor to perform frequent inspections of oil and gas facilities where oilspill equipment is maintained. No similar requirement is contained under Operating Order Nos. 2 or 7.

Recommended Stipulation 7 - Discharge of Produced Water, Drilling Muds and Cuttings

The following stipulation was adopted for Lease Sale 87 and is intended to maintain water quality and protect fish and wildlife resources by restricting the discharge of produced water and drilling effluents. Consequently, we support its adoption in Lease Sale 97.

"Discharge of produced water into open or ice-covered marine waters of less than 10 meters in depth is prohibited. Discharges into waters greater than 10 meters in depth are subject to a case-by-case review of the local environmental factors and consistency with the conditions of a development/production phase general National Pollutant Discharge Elimination System (NPDES) permit for the sale area." 7-6

"Discharges of drilling muds and/or cuttings during the exploration and development/production phases are subject to the conditions of NPDES permits issued by the Environmental Protection Agency."

Information to Lessees (ITL)

The state recommends that ITL No. 2 - Information on Areas of Special Biological and Cultural Sensitivity be modified to include two additional areas of special biological sensitivity: the Colville Delta and coastal salt marshes from Kogru Inlet to the west side of Smith Bay. The biological importance of these two areas are briefly described below.

The Colville Delta is the most biologically productive delta on the Alaskan Beaufort Sea coast. More species of fish occur within the Colville River than any other Alaskan North Slope river, and the Colville Delta provides critical spawning and over-wintering habitat for many of the species present. High densities of ducks, geese, and loons nest in the Colville Delta, including the largest population of tundra swans, white-fronted geese, black brant, and yellow-billed loons on the Alaska North Slope. The Colville Delta also provides important staging habitat for a variety of waterfowl and shorebirds. In addition, caribou, polar bears, and spotted seals occur in the Colville Delta at various times of the year. 7-7

The salt-influenced wetlands between Kogru Inlet and the west side of Smith Bay are of crucial importance to waterbird populations using the Teshekpuk Lake area and to migrants traveling through the area. These wetlands, with their

associated bays and lagoons, support large populations of many waterbirds including black brant, Canada geese, ducks, shorebirds, and seabirds during the late summer-early fall period when they are preparing for their southward migration. Habitats such as these are essential to provide necessary forage for building energy reserves for fall migration flights. These salt-influenced wetland habitats are maintained by periodic influx of sea water, primarily during storm tides. Such processes could make these wetlands particularly vulnerable to impacts from oilspill events.

ENCLOSURE 2

Critique of the DEIS Impact Assessment for Sale 97

While the DEIS provides useful information on environmental and social issues associated with leasing in the Beaufort Sea, it is difficult to obtain a clear understanding of the potential impacts from oil and gas development when they are evaluated over an area as large as the Beaufort Sea planning area (21.2 million acres). Evaluating impacts over such a large area tends to discount impacts to local areas or benefits from deferral alternatives, on the basis that the net loss or benefit would be insignificant in terms of the overall action. For example, the DEIS on page IV-E-8 states "Alternative IV, the Barrow Deferral Alternative, would not change the regionwide effects of the proposal on subsistence resources or on subsistence activities. However, the deferral would substantially reduce effects of noise and traffic disturbance on Wainwright's and Barrow's subsistence harvest patterns (emphasis added)." By evaluating impacts on a regionwide basis, the DEIS concluded that the overall subsistence effects would remain moderate with or without adoption of the deferral, irregardless of the identified benefits for Barrow and Wainwright subsistence users. This same general approach of discounting oilspill impacts or potential benefits of deferral alternatives, because they would affect only a very small percentage of the planning area, is taken throughout the DEIS impact analysis. 7-8

Specific to the above example, we also note that the DEIS conclusion that effects would remain moderate appears to be in error. Table III-C-1 identifies that the population of traditional Inupiat Villages in the North Slope Region totals 5,272, and that Barrow and Wainwright together total 3,582 or 68 percent. If the adoption of the Barrow Deferral would substantially reduce the effects on subsistence harvest patterns for 68 percent of the population, it is logical that even the regionwide level of effects should be reduced. The DOI appears to be attempting not to identify any significant benefits from adopting the Barrow Deferral Alternative. 7-9

The state is also concerned that, except for the Worst-Case Scenario Analysis, the DEIS does not contain any specific analysis regarding the effects of oilspills or noise disturbance in the Chukchi polynya. This ice lead system is an important spring migration pathway for bowhead and beluga whales and numerous species of waterbirds, particularly eider ducks. It also acts to concentrate these species both spatially and 7-10

temporally which could significantly increase their vulnerability to oilspill or disturbance impacts. For example, the entire population of bowhead whales pass through this lead system from mid-April to early June, and in some years the majority of the migration may occur within a two week period. It is also believed that the entire eastern Beaufort Sea stock of beluga whales, estimated at 11,500 animals, move through this nearshore lead system in spring. Furthermore, the open lead provides essential early-season resting, staging, and feeding habitat for large numbers of alcids, larids, waterfowl, and loons during late April to late June, and extremely large concentrations may occur when inclement weather forces migrants to "stop-over." Unlike the DEIS, the Barrow Arch Synthesis Report repeatedly acknowledges the importance of the Chukchi polynya as a migration corridor, and the high degree of vulnerability to species using this area from potential oilspill or noise disturbance impacts. A detailed analysis on this issue should be provided in the Final Environmental Impact Statement (FEIS) under the Environmental Consequences Section rather than the Worst-Case Analysis. Additionally, it should address potential impacts that could occur to all species using this lead system.

The FEIS should also include a discussion on the potential impacts from oil tankers utilizing this ice lead system. The assumption that oil produced in the Chukchi Sea would be transported to market by a proposed Chukchi Pipeline and the Trans Alaska Pipeline is flawed. The DEIS states on page II-9 that "to justify a pipeline across the southern part of NPR-A, it is assumed oil is also discovered in the Chukchi Sea Planning Area (proposed OCS Sale 109), in the southern part of NPR-A, or both." Electing not to discuss the potential impacts of tankering oil based on the assumption that additional oil will be discovered to support construction of a pipeline is unjustified. 7-11

The last key issue we wish to discuss includes four general concerns regarding the DEIS impact analysis for bowhead whales. First, we note that the overall marine mammal impact projection for Sale 97 significantly differs from the Sale 87 projections. In Sale 97, overall effects are projected to be minor for both endangered and non-endangered marine mammals, while Sale 87 predicted moderate impacts. Although some additional information on potential effects of noise disturbances to marine mammals was obtained between Sales 87 and 97, we would like to know what information MMS has to justify reducing the overall impact projection, which includes both oilspill and noise disturbance effects. 7-12

Secondly, the DEIS fails to include an updated Biological Opinion on endangered whales for Sale 97. This omission restricts the public's opportunity to review and comment on this important document with regard to Sale 97. 7-13

Third, the DEIS appears to discount the potential impacts of an oilspill to bowhead whales. Even under the Worst-Case Scenario, the DEIS states that "In the unlikely event that all negative effects occurred, a low number of whales (less than 100) might be killed; and the overall effect would be to slow the recovery of the bowhead whale population to a nonendangered status." This conclusion contradicts the National Marine Fisheries Service's Biological Opinion for Sale 87 which concludes that such an event would likely jeopardize the continued existence of the species. The DOI should explain why these two impact predictions differ so markedly. 7-14

Finally, we note that the DEIS contains several speculative conclusions that are not fully supported by available information. For example, page IV-B-49 states that "bowheads possess enzymes capable of metabolizing or detoxifying small quantities of ingested oil (Hansen, 1985)." Although it has been determined that some cetaceans do contain such enzymes, to our knowledge, no research on the presence of these enzymes has been conducted on bowhead whales. Similarly, the following paragraph states that "it is likely that any small quantity of ingested oil would be broken down by digestive process and would not block the intestine (Hansen, 1985)." To our knowledge, no scientific information exists to support this claim and we believe definitive studies should be undertaken by MMS on this topic before drawing such conclusions. In terms of noise disturbance, the DEIS summary statement that bowhead whales "may avoid feeding within several hundred meters of drilling units and production platforms" (page IV-B-54) is an underestimation of the available data. The DEIS even provides a reference (Richardson et al. 1985a) on page IV-B-53 which identifies that bowheads may respond adversely to drillship noise out to two kilometers from the sound source. Caution must be exercised in the DEIS not to misrepresent the available information or to reach unsupported conclusions. 7-15

Response 7-1

This concern is addressed in Section I.B.3.e.

Response 7-2

This concern is addressed in Section I.B.3.e.

Response 7-3

This concern is addressed in Section I.B.3.e.

Response 7-4

The MMS believes that Stipulation No. 3--Protection of Biological Resources--as written provides adequate protection for the biological resources of the planning area.

The stipulations proposed in the FIS generally apply to the OCS and leasehold--the area over which MMS has jurisdiction and enforcement authority. If biological populations or habitats outside of the area of MMS's jurisdiction are identified, they can be noted when exploration and development and production plans are reviewed by Federal and State agencies and the public; and, at that time, measures can be recommended that would help protect the biological resources.

The RSFO is required to provide a written notice to the lessee if biological surveys are to be conducted based on the identification of biological populations or habitats that may require additional protection. This notice would provide the written determination that special biological resources exist.

Applicable laws, regulations, orders, and stipulations provide the legal foundation for the required protection of the biological resources associated with the planning area. The Protection of Biological Resources Stipulation specifies those identified biological resources or habitats that may require more protection than is provided by the existing legal requirements.

Response 7-5

The concerns evident in this proposed stipulation are already addressed by Alaska OCS Region OCS Order No. 7, as interpreted in MMS Alaska OCS Region Planning Guidelines for Approval of Oil Spill Contingency Plans (July 29, 1982)--see Allen et al. (1984), incorporated by reference in Appendix C. These guidelines already require annual plus additional drills--all "under realistic environmental conditions"--if drilling operations continue into new seasonal environmental conditions. The guidelines also require exercises that test the alerting/initial response mechanism and command, control, and communications be held as frequently as necessary to demonstrate effectiveness to the OSC. The guidelines--including drill requirements--were formulated in consultation with the USCG and are considered adequate to maintain response performance by both MMS and USCG.

The OCS Order No. 7 (paragraph 3.1) already requires that spill-response equipment and materials on oil and gas facilities be inspected monthly and maintained in a state of readiness for use.

Note that MMS considers the drills conducted in Captains Bay outside of Dutch Harbor to meet the guideline requirement of "realistic environmental conditions" for southern Bering Sea leases, including Sale 70 leases in the St. George Basin and Sale 83 leases in the Navarin Basin. The term "realistic environmental conditions" is not interpreted by MMS or USCG to mean as severe as the "average" conditions--which could be sufficiently severe to preclude response with mechanical equipment or to at least endanger response personnel and risk damage to response equipment.

Response 7-6

The EIS analysis is required to assume that all existing laws and regulations are followed. The EPA is required to conduct ODCE and NPDES analysis for discharges from exploration, development and production, and construction activities in order for the EPA to ensure that no significant degradation of water quality would occur from such activities. The analysis for the EIS must assume that the EPA meets its legally mandated responsibilities and, therefore, must assume that no significant degradation of the environment would occur. As noted in Appendix L, EPA expects to issue a general permit for exploratory drilling operations for Sale 97 and may elect to issue individual NPDES permits for future development and production operations for Sale 97.

If the Secretary decides to conduct a lease sale, there are several steps remaining in the leasing process that must be taken before the sale can be conducted; these steps are described in paragraphs 11 through 13 of Section I.A. As noted in these paragraphs, the Secretary reaches the final decision regarding the proposed sale after considering other new pertinent information and the recommendations of the Governor of the State of Alaska. Thus, other stipulations, such as the Discharge of Produced Water, Drilling Muds, and Cuttings from the Sale 87 NOS, can be considered in each lease resulting from Sale 97 at this time.

Response 7-7

The concern regarding fishes is addressed in Response 2-15.

The concern regarding waterfowl and shorebirds is addressed in Response 2-3. The Colville River Delta has been added to ITL No. 2. All saltmarsh habitats along the coast of the Sale 97 area have been identified as sensitive habitats in the coastal habitat-vulnerability index used in various oil-spill-contingency plans (Alaska Clean Seas, 1983a, b).

Response 7-8

These concerns are addressed in Response 2-1.

Response 7-9

This concern is addressed in Response 1-4.

It should also be noted that a MODERATE effect is not small--it indicates that the subsistence harvest would be eliminated for up to a year.

Response 7-10

The EIS discusses the effects of oil spills and noise on beluga whales and other marine mammals in the offshore lead system from Cape Lisburne to Point Barrow, which the commenter refers to as the "Chukchi polynya," in Section IV.B.4.a(1)(e); see also Figure IV-14, the Spring-Migration Area. In the discussion of marine and coastal birds, the offshore lead system is referred to as the Seabird-Feeding Area in Figure IV-13. The effects of oil spills on birds in this area are discussed in Section IV.B.3.a(1)(b) and the effects of noise in IV.B.3.a(2).

The effects of oil spills and noise on bowhead whales--as discussed in Section IV.B.5.b--are applicable to all marine areas through which the bowheads migrate, including the spring lead system, regardless of season. In addition, the worst-case analysis discusses the specific case of a large oil spill in the spring lead system. This discussion should address the commenter's concern. The inclusion of this spill scenario in the worst-case analysis does not imply that it could not happen; however, the probability of its occurrence is very low. Due to the severe ice conditions present during the spring whale migration, drillships and non-icebreaking vessels would not normally be expected to be present in or near the spring lead system at this time. Consequently, there should be little if any noise associated with OCS oil and gas exploration or production activities in the spring lead system unless a bottom-founded drilling unit or production platform were located in or near a lead. Section IV.B.5.b has been amended to address this concern.

Response 7-11

An economic assessment is made of the various types and numbers of production and transportation facilities that may be constructed and operated based on the mean-case resource estimates for the proposal and the deferral alternatives. Given that a major oil-transportation infrastructure is in place, it was reasonable to assume that oil would be transported from the offshore-production platforms to TAP via pipelines. Although an estimate is given for the total pipeline length that might be feasible for transport of the oil to TAP, the location of any potential petroleum reservoirs is not known. Therefore, some assumptions, as noted in Section II.A.3, had to be made as to where the Sale 97 production platforms might be located. Because the estimated total pipeline length is not sufficient to connect both platforms to TAP, some additional assumptions had to be make to complete the pipeline connection; Section II.A.3.

The scenarios for the proposal and the alternatives do not include tankering of crude oil and, therefore, the effects of such tankering are not considered in the analysis of the Chukchi Sea portion of Sale 97. However, possible effects that could result from tankering of oil through the planning area are discussed as part of the cumulative case.

Response 7-12

The resource estimate for Sale 87 was substantially higher than the estimate for Sale 97 (almost five times higher). This resulted in an estimate for Sale 87 of about three times more exploration and delineation wells, three times more drilling units, four times more production platforms, five times more production and service wells, and seven times more oil spills of 1,000 barrels or greater than for Sale 97. The higher level of effect that potentially could result from exploration and development and production activities and oil spills for Sale 87 led to the conclusion of a higher level of effect on marine mammals and bowhead whales.

The difference in the level of estimated effect on nonendangered marine mammals between the Sale 87 FEIS and the Sale 97 FEIS also reflects more recent knowledge acquired from studies concerning noise and disturbance of marine mammals. In the case of nonendangered marine mammals--specifically, ringed seals--the Sale 97 FEIS conclusions of the on-ice experiments regarding seismic disturbance of denning ringed seals indicate that this potential disturbance source has a MINOR or NEGLIGIBLE effect on the distribution and abundance of ringed seals. At the time the Sale 87 FEIS was written, seismic disturbance was thought to have a significant effect on seal distribution.

Response 7-13

Consultation for Sale 97 was initiated by MMS with the NMFS on July 17, 1985. Prior to receiving the biological opinion, we provided NMFS with additional information on several occasions and conducted informal discussions on the progress of the consultation. The MMS received the NMFS biological opinion on endangered whales on May 19, 1987; it is included in Appendix J.

Response 7-14

One possible explanation is that seven times more oil spills were estimated for Sale 87 than for Sale 97. In addition, we are unable to find evidence to indicate a substantial number of bowhead whales would be killed or injured as the result of an oil spill. Any oil spills that might occur would cover a rather small area, and even a large spill of 10,000 barrels under open-water conditions would cover only 1 to 2 square kilometers. Oil is unlikely to adhere to substantial areas of bowhead skin, and experiments with oiling the skin of other cetaceans have resulted in minor and transient effects. Baleen fouling, should it occur, has been shown to be reversible in 24 to 48 hours. Bowheads are unlikely to consume enough contaminated prey items to be harmed. About the only conditions we could foresee as potentially causing serious harm to bowheads from an oil spill are (1) if bowheads were trapped in a small open-water pond or lead into which a large quantity of fresh crude or refined product is spilled such that bowheads are forced to repeatedly surface through oil and inhale petroleum vapors or (2) if bowheads were to aspirate (inhale) regurgitated hydrocarbons of the type found in a fresh spill. We believe the probability of this happening is very low. Appendix C, Section I.D, describes the fate and behavior of spilled oil in a lead or polynya. Spilled oil would be blown to its downwind edge, where it would accumulate in a band. Here, it would be either frozen into the ice or contained behind accumulating brash ice. In any case, it is unlikely that oil would completely cover the surface of the water, except in cracks and very small pools. Also, with the oil situated along the downwind edge of the lead, any toxic vapors would be carried away from the lead by the wind. Volatile compounds are lost from an oil slick within 24 to 48 hours, much of this by evaporation (Jordan and Payne, 1980). Geraci and St. Aubin (1986) predict that at the source of a fresh spill of light crude oil, vapor concentrations of several thousand parts per million could occur (which could be harmful) but should not persist for more than a few hours.

In order for petroleum hydrocarbons to be regurgitated and aspirated, they must first be ingested. This would seem to require that bowheads be feeding in the vicinity of spilled oil and that they ingest oil with prey items or feed on contaminated prey items. This would be unlikely to occur as it appears bowheads feed very little during their northward migration (Frost and Lowry, 1981b), although feeding occurs in some areas during some years (Hazard and Lowry, 1984; George and Tarpley, 1986).

Response 7-15

Geraci and St. Aubin (1986) state that in fish and mammals, ingested hydrocarbons are metabolized by enzyme systems in the liver and are excreted in the urine. These enzymes are ubiquitous in mammals (Gillette, Davis, and Sasame, 1972) and have been demonstrated in other whale and dolphin species (Geraci and St. Aubin, 1982), and it is reasonable to assume that they also exist in bowhead whales (Geraci and St. Aubin, 1986). There is no evidence to indicate that small amounts of ingested oil would block the gastrointestinal tract of bowheads. There is evidence that bowheads would be capable of metabolizing small quantities of ingested oil (Geraci and St. Aubin, 1986). There is no evidence to indicate that whales would knowingly ingest large amounts of oil. Rocks and other indigestible materials found in bowheads' stomachs appear to have had no harmful effect (Lowry and Burns, 1980); clam shells have been found in the lower intestine (Frost and Lowry, 1981b) that cleared the channel; and manatees, which have a considerably smaller pyloric opening (Reynolds, 1980), pass tar balls without any obvious effects (Smithsonian Institute, 1981a,b,c). Testing the hypothesis that bowheads can metabolize and pass crude oil and petroleum products is highly impractical. Consequently, inferences from related species must suffice.

The text in Sections IV.B.5.b and c has been amended to address the concern regarding the effects of noise.

NORTH SLOPE BOROUGH

OFFICE OF THE MAYOR

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George N. Ahmaogak, Sr., Mayor

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January 12, 1987

Mr. Dick Roberts
Regional Director
Alaska OCS Region
Minerals Management Service
949 East 36th Avenue, Room 110
Anchorage, Alaska 99508-4302

Dear Mr. Roberts:

Please regard this letter as the response of the North Slope Borough to your call for comments regarding the proposed Beaufort Sea Lease Sale 97. As the area-wide local government for the northernmost region in Alaska, bordering the Beaufort and Chukchi Seas, the Borough speaks to those potential impacts of greatest concern to the people of its member villages who rely upon subsistence resources for their sustenance.

The Borough would support the proposed Beaufort Sea Lease Sale Number 97, upon the following conditions:

1. That the 201 blocks described in the draft environmental impact statement (DEIS) as Alternative IV, Barrow Deferral, be deleted from the sale and deferred for at least five years;

2. That the 161 blocks as described in DEIS Alternative V, Kaktovik Deferral, be deleted from the sale and deferred until currently ongoing research is concluded and that area is found not to be a critical feeding habitat for the bowhead whale;

3. That stipulation #4, seasonal drilling restriction for protection of bowhead whales from potential affects of oil spills, as set forth in the DEIS on page II-16, be incorporated into each lease; and

4. That a further stipulation be included in each lease which restricts any drilling to above threshold depth prior to the commencement of bowhead whale migration.

5. The North Slope Borough has no objection to exploration in the Chukchi Sea lease area. However, the Borough recommends that studies be made in this area to adequately describe the life forms present and their interrelationships. The Borough is concerned that this area lacks a data base which is needed to make reasoned decisions, in particular with regards to the subsistence resources and their habitat. The Borough also realizes that the main pack ice movements within the proposed lease area will pose new problems for industrial exploration and development. Therefore, it is recommended that studies of sea ice dynamics be conducted prior to any activity taking place.

The NSB joins the Alaska Eskimo Whaling Commission in its support of deferral of both the Barrow area (Alternative IV) and the Kaktovik area (Alternative V) from Lease Sale Number 97.

IN SUPPORT OF THE BARROW DEFERRAL ALTERNATIVE (IV)

The Barrow Deferral is particularly important because of the ice dynamics of the Pt. Barrow area, the many animal species that live in and migrate through the zone, and the people that use these animals. During the winter and spring the pack ice and shear zone are closer to land in the Barrow Deferral area than at any other place along the Beaufort Sea coast. The shear zone is the dynamic area between the pack ice and the landfast ice. The pack ice is moved by winds and water currents creating leads of open water within the shear zone. When the pack ice is pushed close to the landfast ice there is a limited amount of open water in which marine mammals using this area may surface. An oil spill or oil which has been trapped in the ice and released by melting could cover all open water in the area. Industrial activity in the area could displace animals and affect the subsistence hunt.

Bowhead and beluga whales are particularly susceptible to industrial activity in the Barrow area because they must migrate through the area. Oil covering the open water could block the migration route or force whales into contact with oil. The presence of spilled oil presents a clear danger especially regarding ingestion and contact with the eroded areas of skin of the bowhead whale (Albert, 1981). Oil may adhere to rough skin or tactile hairs (Haldiman et. al., 1981), and it reduces the filtering efficiency of bowhead whale baleen (Braithewaite et al., 1983). It is stated on page IV-B-49 that whales trapped in an oil covered lead from which they could not escape could die or suffer pulmonary distress as a result of breathing petroleum vapor. This is possible in the Barrow area. Bowheads have been observed in the Barrow area continually returning to the same polynya presumably because there was no more open water where they could surface (Carroll and Smithhisler, 1980). The actual inhalation of oil is also possible. Very close range observations (within 5 meters) have been made of bowhead whales and it was seen that water pooled in the closed external nares when the whales surfaced (Carroll and George, 1985). Oil on the surface of the water would probably also collect in the external nares and adhere to the folds of skin and tactile hairs surrounding the blowhole. The skin around the blowhole is often quite abraded from rubbing on ice and would provide another surface to which oil could adhere. There could be some oil remaining after the exhalation so the powerful inhalation, pulling air past these hairs and skin, could pull oil into the respiratory tract. 8-1

Bowhead whales have behavioral traits that increase their likelihood of contacting oil spills. It is stated on page IV-B-49 that only a small fraction of the bowhead population would likely occupy an affected lead at any given time. In fact much of the population could occupy a section of the lead anytime from April to June. Bowheads can be seen migrating past Pt. Barrow from early April through June, but often they pass in pulses where a large percentage of the whales pass during a short time period. For instance, in 1985, 43% of the whales counted were seen during 3% of the watch season (George et al., 1987). These pulses generally occur during late April and early May. There are exceptions as in 1980 when no whales were seen until 21 May and 70% of the population passed from 24 through 27 May (Krogman et al., 1982). Cows with calves also often pass during a relatively short time. For example, 38 of 59 calves counted in 1986 were seen from 21 May through 30 May (George et al., 1987). Therefore, an accident at the wrong time could have a profound effect on the population. 8-2

One of the reasons given for the Barrow Deferral on page II-26 of the DEIS is that during the fall bowheads feed in the area east of Pt. Barrow. The Pt. Barrow area, not just the area east of Pt. Barrow, is periodically an important feeding area. Ljungblad et al. (1985) reported that the largest aggregations of feeding bowhead whales observed during their 1984 fall surveys along the Alaskan and Canadian Beaufort Sea coast were near Pt. Barrow. Forty five to seventy feeding whales were seen on 3 separate days over a 6 day period (22 Sept. - 28 Sept.).

Feeding occurs in the Pt. Barrow area during the spring as well as the fall. Each of the 3 whales harvested near the village of Barrow during the spring of 1985 had over 5 liters of recently eaten food in its stomach and one had 16-24 liters. The food consisted mostly of calanoid copepods and euphausiids (Carroll and George, 1985).

Intensive feeding behavior was observed 11.2 km southwest of Pt. Barrow by North Slope Borough Whale Census observers from 25 May to 6 June 1985. At least 60 bowheads were seen feeding during a period of 12 days. There were often up to 12 whales feeding at a time. Individual bowhead whales were seen in the area for up to 15 hours (Carroll and George, 1985). 8-3

Feeding was spread over a considerable time and distance. Stomach contents were collected from a whale on 9 May and feeding behavior was observed on 6 June. Therefore feeding activity occurred for over three weeks (Carroll and George, 1985). Bowhead whales which were harvested were presumably feeding south of the village of Barrow. Bowhead whales were observed defacating and other bowheads were seen with sediments streaming from their mouths north of Pt. Barrow*. These are apparently results of feeding (Wursig et al., 1985). Therefore, feeding activity occurred in an area at least 20 kilometers in length.

*Nerini, M.K., National Marine Mammal Lab, 7600 Sand Point Way Bldg. 32, Seattle WA 98115, Personal Communication.

During the spring of 1986 bowhead whales were again seen feeding in the Barrow area. On both 5 and 6 June at least 9 whales were seen feeding from 29 km south-west of Barrow to north of Pt. Barrow and one whale was seen defecating in the area. Of the 7 whales harvested in Barrow, 4 had food in their stomachs and one contained approximately 60 liters of zooplankton (George et al., 1987). The Barrow Deferral area is obviously a feeding area during spring and fall.

Polar bears could be affected by industrial activity on the ice. Exploration on the Beaufort Sea could have a major impact on female polar bears with cubs. According to information gathered from radio-collared bears, 87% of female polar bears den on sea ice. Disturbances could cause females to abandon dens and endanger cubs who are too young to survive outside the den.* 8-4

An oil spill can be hazardous to polar bears if the fur is fouled or if oil is ingested. As stated on page IV-B-35 polar bears are not likely to avoid oil spills. In fact, they are very curious and may approach them intentionally. Oil readily clings to polar bear fur and reduces the ability to thermoregulate. The heat conductivity across the skin is greatly increased and metabolism is increased to compensate (Hurst et al., 1982; Oritsland et al., 1981). This can lead to hypothermia and possibly death. 8-5

Ingestion of oil could occur if a polar bear came into contact with oil and subsequently groomed itself by licking its fur or ate food contaminated with oil. Ingested oil severely affects the blood and renal functions of polar bears and has led to the death of 2 captive polar bears. The bears had groomed their fur after contacting oil (Oritsland et al., 1981; Englehardt, 1981). Thus oil exploration could be damaging to local populations of polar bears.

Ringed seals are particularly vulnerable to oil in ice because of their behavior. They scratch breathing holes and entrances to subnivean birth lairs in the ice. Both the breathing holes and the access holes to birth lairs would tend to concentrate oil. Fouling of the fur and inhaling fumes could result. Oil decreases the insulative value of the fur. Pups are particularly affected because they have little or no blubber for insulation (National Research Council, 1985). 8-6

Seals are commonly hunted in the Barrow Deferral area and an oil spill in the area could seriously affect subsistence hunting opportunities.

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*Amstrup, S., U.S. Fish and Wildlife Service, 1011 East Tudor Road, Anchorage, AK 99503, Personal Communication.

IN SUPPORT OF THE KAKTOVIK DEFERRAL ALTERNATIVE (V)

The Borough is convinced that a major feeding area of the bowhead whale is within the Kaktovik Deferral area. Oil spills and/or acoustic disturbances from oil and gas exploration and development are likely to endanger the whales, reduce the availability of the feeding area to them, or both.

Leasing in the Kaktovik Deferral area should be deferred until there is convincing evidence that this area is NOT an essential feeding habitat for bowhead whales. The present study funded by Minerals Management Service is expected to provide data useful in determining the value of this area to feeding whales. However, simply conducting such a study does not infer that enough data will be collected. If there is not enough information to make a reasonable judgement about the Kaktovik Deferral area, then both research and deferral must continue. 8-7

The Kaktovik Deferral Area is an area used by the bowhead whales during their annual fall migration. The Inupiat subsistence whalers have long known these waters to be a feeding area for bowhead whales. For this reason it is felt that more intense studies are required to properly define the nutritional importance of the area to bowhead whales. We strongly feel that there should be additional studies regarding industrial noise impacts to feeding and/or migrating bowhead whales. Thus, the Borough recommends that the Kaktovik area be deferred to allow for the completion of studies which will develop an adequate data base.

ADDITIONAL COMMENTS:

1. Speculation

The sale 97 DEIS contains a great many speculative statements. We are concerned that many of these statements are not based on hard or conclusive evidence. Following are three examples:

a. Habituation of bowhead whales to exploration-related and development-related acoustic disturbances is mentioned on pages IV-B-53 (paragraph 2) and IV-B-56 (paragraph 2). The DEIS states that "... habituation to distant geophysical seismic activities could occur (and is likely to already have occurred)..." There is no conclusive evidence for this statement, only previous speculation. 8-8

b. The DEIS predicts minimal effects on bowhead whale behavior from undersea pipeline installation (page IV-B-50, paragraph 3), vessel activity (page IV-B-52, paragraph 2), and seismic noise (page IV-B-53, paragraph 2). These statements are also highly speculative. 8-9

There have been a number of studies of industial acoustic effects on bowhead whales. Such studies have gathered useful information and should be continued. Recording the behavior of bowhead whales at various 8-10 distances before, during and after specific industrial underwater sounds provides valuable data. However, these data are not sufficient for reliably predicting the effects of industrial undersea noise on bowhead whale migration, feeding behavior or mating behavior.

c. The DEIS states on page IV-B-50 that, after a spill, oil-contaminated prey would probably comprise only a small fraction of bowhead whale food intake. There is no sound basis for this comment. Depending on the location and size of the spill, contaminated prey may comprise a large fraction of food consumed by the whales. 8-11

The feeding behavior and feeding locations of bowhead whales are poorly understood. Therefore, it is unfair to the DEIS reader to give the impression that reliable predictions about prey consumption can be made. 8-12

There are two conclusions to be drawn from these examples. First, the Barrow and Kaktovik Deferral areas should be deleted from Lease Sale 97 because there is not yet enough information to determine the effects of oil spills and industrial noise on bowhead whales. 8-13 Second, the final DEIS must show clearly which statements are based on hard evidence and which statements are speculative. Far-reaching decisions will be made on the basis of the final Sale 97 EIS. The readers who will make these decisions must be presented with accurate and unbiased information. 8-14

2. Underestimation of Effects of Oil and Gas Exploration

A second major failing of the DEIS is that the potential effects of oil and gas exploration and development are generally underestimated. Following are a number of specific examples of such underestimation:

a. The potential effects on the BOULDER PATCH community are rated as MODERATE (page IV-B-12, paragraph 3 and page IV-B-13, paragraph 2). The DEIS states, on page III-14, paragraph 2, that the Boulder Patch contains the largest kelp community described to date. Thus, one concludes that the Boulder patch kelp community may contain most of the regional kelp population. The potential oil impact to such a community could be MAJOR. If an oil spill reached the Boulder Patch area, "abundance and/or distribution of the regional population could decline beyond which recruitment could not return to former population levels within several generations". According to Table S-2, this is the definition of a MAJOR effect. 8-15

b. The DEIS predicts the effects of oil on anadromous fish in the Beaufort Sea to be MINOR or possibly MODERATE (page IV-B-17, paragraph 1). Regional arctic char populations overwinter and spawn in specific coastal rivers. If an oil spill occurred during the peak exit from the river or return to the river, the numbers of all age classes could be drastically reduced. Recovery would take a number of generations. According to Table S-2, this effect would be MAJOR. 8-16

c. On page IV-B-54, paragraph 3 ("(a) Summary"), the DEIS states that, as a result of an oil spill, a few bowhead whales may be affected and the effect would be MINOR. This paragraph represents one of the worst underestimates in the entire document. If oil entered the lead during the spring whale migration, many if not all of the migrating whales could be affected. The population could decline in abundance due to loss of calves, death of sexually mature adults, abortion by pregnant cows or reduced reproductive capability of sexually mature whales. Recovery could take many generations. Such an effect is MAJOR. 8-17

d. The cumulative effects of oil development on bowhead whales could hardly be less than the effects of development on bowhead whales in the Sale 97 area alone. Therefore, the potential cumulative effects of oil development on bowhead whales are MAJOR not MODERATE (page IV-B-56, paragraph 3). 8-18

e. Based on the preceding paragraphs (c and d), the Worst Case Analysis for bowhead whales (pages IV-I-1 through IV-I-3) is greatly underestimated. There is no mention in the analysis that some or all of the calves in the whale population could be affected or lost. There is no discussion of potential decline in population reproduction after contact with an oil spill. The Worst Case Analysis should be rewritten to be more realistic. The expected effects should be MAJOR, not MODERATE. 8-19

f. The DEIS states (page IV-B-90, paragraph 1) that the "... effects to the harvest of bowheads due to oil spills may be MODERATE ...". In the case of an oil spill in the spring lead system, bowhead whales would be contaminated with oil. The subsistence hunt could be greatly reduced or eliminated for one or more seasons because of dangers to humans if they consumed contaminated whales. A greater impact to the subsistence hunt could come from the International Whaling Commission (IWC), which sets the subsistence harvest limits. If there were an oil spill during the spring whale migration, the IWC could ban the subsistence hunt until the effects of the spill on the whale population were assessed and the population had recovered. Such an assessment and population recovery may well take years. The subsistence harvest could be banned for years, a MAJOR effect on the subsistence hunt according to the definitions in Table S-2. 8-20

g. The potential effects on beluga whales are predicted to be MINOR (page IV-B-44, paragraph 4). An oil spill in the spring lead system could, however, have nearly the same effect on the beluga whale population as on the bowhead whale population. 8-21

The potential negative impacts discussed in examples a through g above are a basis for deferring the Barrow and Kaktovik Deferral areas: the potential harmful biological and cultural effects of oil exploration and development in the Barrow and Kaktovik Deferral areas are so great that leasing in these areas must be deferred.

An example of more realistically predicting potential biological impacts of oil and gas exploration and development is the Draft Arctic National Wildlife Refuge, Alaska, Coastal Plain Resource Assessment (November 1986) by the U.S. Fish and Wildlife Service. The USFWS document is also more realistic about decreases in potential impacts with alternative proposals.

3. Unrealistic Comparison of Effects Between the Proposal and Alternatives

We are greatly concerned that, in Table S-1, there are very few predicted decreases in negative impacts from Alternative I (the proposal) to any of the three deferral alternatives. Of 54 possible changes in effects on plants, animals and subsistence (Resource Categories 1 - 6 and 9), predicted declines in effect from proposal to an alternative occurred in only (1) pinnipeds, polar bears, beluga whales in Alternative VI and (2) gray whales in Alternative IV. 8-22

We feel that, in reality, the deferrals would provide many more decreases in effect. Therefore, comparisons of potential effects between the proposal and alternatives should be corrected in the final EIS.

4. Poor Understanding and Appreciation of Subsistence

The DEIS demonstrates a gross lack of understanding and appreciation of subsistence hunting and fishing. The treatment of potential dangers to bowhead whales and to the bowhead whale subsistence harvest are prime examples. 8-23

Another example is seen on page IV-B-91, paragraph 4 (labelled " (c) Effects on Fish Harvests") in the first sentence: "While fish do not serve as Inupiat cultural symbols as do bowhead whales and caribou, their reliability and year-round availability make them a very important subsistence staple." Statements such as the phrases about fish not being cultural symbols are UNNECESSARY and may be offensive to noncoastal Inupiat. Many noncoastal Inupiat people are not associated with the bowhead whale hunt, and fishing is a primary subsistence activity for them. The statement about year-round availability is misleading. Fish availability is relatively low from about February through breakup because the ice is too thick for under-ice netting. 8-24

5. Inconsistent Statements

There is inconsistency in the DEIS discussions of oil and gas exploration and development effects passing from lower to higher trophic levels. On the first page of Table II-C-1, the DEIS states that no effects on lower trophic organisms are expected to be passed on to higher trophic levels. The inconsistency appears on page IV-B-18, paragraph 2: "Fish populations may be affected indirectly, through effects on food sources...". 8-25

6. Additional Comments Regarding Fish and their Subsistence Use

The list of "important fishes based on numerical abundance or human use" (page III-19, 2nd to last sentence) has an important omission--broad whitefish. Regarding Barrow, Atqasuk and Nuiqsut, arctic cisco and broad whitefish are the 8-26

preferred species (George and Nageak, 1986). It was estimated that in 1985 20,000 lbs of broad whitefish, 28,000 lbs. of arctic cisco and over 300 arctic char were harvested by Nuiqsut residents (Moulton et al., 1986). This exceeded the reported commercial catch in the Colville for that year (Moulton et al., 1986). Few arctic cisco are captured in the Admiralty Bay drainages, however broad whitefish, humpback whitefish, least cisco and burbot comprise the bulk of the catch (J.C. George, Department of Wildlife Management, North Slope Borough, Barrow, AK., unpublished field notes). An estimated 2,000-4,000 arctic char were taken at Kaktovik in 1985 (Envirosphere Co., 1985).

The DEIS states (page III-20, second para., sentence 6) that arctic cisco recruit to the Colville river "every three to four years". There are not sufficient data on recruitment of arctic cisco to suggest this; furthermore both 1985 and 1986 were large recruitment years for arctic cisco into the Colville and mid-Beaufort (Envirosphere Co., 1985 and 1986). From the second part of the sentence that reads "juvenile fish may use Alaskan rivers...as overwintering habitat", delete the word "may" as anadromous fish have been documented to use the deltas for overwintering (Adams, 1986; Moulton et al., 1986). 8-27

The DEIS statement (page III-22, sixth para, last sentence) that little is known about the Nuiqsut fishery is incorrect. There are several reports which give detailed harvest data, locations and estimates (George and Nageak, 1986; George and Kovalsky; 1986; Moulton et al., 1986). In 1985 the Nuiqsut catch exceeded the commercial catch. 8-28

The prediction of NEGLIGIBLE effects on subsistence (page IV-B-92) could be MAJOR if an oil spill were to enter the Colville River delta. This is because fishing, particularly in the delta, is the principle subsistence activity in Nuiqsut. 8-29

Nuiqsut has the largest documented subsistence fishery on the U.S. Beaufort Sea coast and this should be mentioned in the summary of subsistence effects (page IV-B-94) (Moulton et al., 1986). 8-30

SALE 97 BIOLOGICAL OPINION

Finally, the Borough objects to the absence from the DEIS of a draft biological opinion as to the potential effects of Sale 97 OCS oil and gas leasing and exploration activities on endangered whales. Such a draft biological opinion should have been prepared pursuant to Section 7 of the Endangered Species Act. Appendix J of the DEIS included a copy of an opinion issued by the National Marine Fisheries Service in relation to Lease Sale 37 on December 19, 1983. This was not really sufficient to afford the public a meaningful opportunity to comment. Moreover, the omission may have constituted a violation of Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA) as it denies the public an opportunity for a comment and hearing process-with the benefit of the findings required by ANILCA Section 810(a). See 16 USC 312 (a) and (b). 8-31

Thank you for your time and consideration upon receiving these comments.

Sincerely,

George N. Ahmaogak, Sr.
Mayor

cc: Edward Itta, Director, Planning Dept.
Harold Curran, NSB Dept. of Law
Warren Matumeak, Land Management Administrator
Ben Nageak, Director, Dept. of Wildlife Management
Arnold Brower, Jr., Chairman, Alaska Eskimo Whaling Commission
Ron Nalikak, Alaska Eskimo Whaling Commission
Nate Olemaun, Mayor, Barrow
Loren Ahlers, Mayor, Kaktovik
Maggie Kovalsky, Mayor, Nuiqsut
Jacob Kagak, Mayor, Wainwright

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Response 8-1

Your concern regarding oil covering an open-water lead is addressed in Response 7-14. Regarding the potential for inhalation of oil that may collect around the blowhole, the typical breathing cycle of cetaceans includes an explosive exhalation followed by an immediate inspiration and abrupt closure of the muscular plug. This mechanism has evolved to prevent inhalation of water and would be as discriminatory of oil (Geraci and St. Aubin, 1980). Gray whales migrate semiannually through an area of natural oil seeps off the California coast, and some animals actually swim through surface oil slicks (Geraci and St. Aubin, 1982). Yet, to our knowledge, there have been no documented cases of gray whales being observed with oil adhering to their bodies or suffering respiratory complications as a result of inspired oil. Likewise, Goodale et al. (1979) observed humpback and fin whales surfacing and feeding in surface slicks of oil spilled from the Regal Sword, yet reported no apparent ill affects from such behavior. Consequently, it would seem most likely that any oil near the blowhole that is not washed away by the explosive exhalation would adhere too tightly to be drawn into the lungs during inspiration.

Response 8-2

The situation discussed in Section IV.B.5.b(1) to which you refer was intended to discuss the specific case of bowheads returning to the same polynya because there was no more open water for them to surface in (such as you referred to Carroll and Smithhisler [1980]). In such a situation, if the polynya were small and oil covered the entire surface, it is possible that the whales trapped there could be seriously harmed by the inhalation of hydrocarbon vapors. However, in such a situation, there would likely be only a small percentage of the whale population present. Vapor concentrations capable of harming whales would generally be expected to dissipate within several hours after the termination of a spill (Geraci and St. Aubin, 1982). While the presence of an oil spill in a larger, more open lead might have the potential to contact more whales because more whales would probably be using this type of lead, the consequences would probably be less serious--the oil would tend to accumulate along the downwind edge of the lead, where it would either be frozen into the ice or contained behind accumulating brash ice. This would leave most of the lead's surface free from oil, and whales contacting oil would probably do so only briefly as they moved through the area.

Response 8-3

The text in Section II.B.2.c has been clarified.

Response 8-4

Oil exploration in the Beaufort Sea would have a MINOR effect on polar bears because most female bears in Alaska den on the sea ice. Polar bear dens are not concentrated on the sea ice but are widely dispersed over a very large area from west of Point Barrow to the Canadian border, and the number of polar bear dens exposed to exploration platforms and other facilities and activities would be few. Thus, the number of females and cubs that could be disturbed and displaced from the dens would be few and would represent a MINOR effect on the population.

Response 8-5

The considerations stated have been addressed in the assessment of potential effects to polar bears in Section IV.B.4.a(1)(b).

Response 8-6

The considerations stated have been addressed in the assessment of potential effects to ringed seals in Sections IV.B.4.a(1)(b), (1)(e), and (6).

Response 8-7

The MMS expects to receive in the next few months final reports on bowhead feeding in the Kaktovik area and potential effects of noise on bowhead whales associated with specific drilling operations in the U.S. Beaufort Sea. This information should supplement the existing database and provide additional information to assist the Secretary in determining whether or not the Kaktovik area should be deferred from leasing.

This concern also is addressed in Response 5-35.

Response 8-8

This concern is addressed in Response 21-24.

Response 8-9

The MMS does not believe that these predictions are highly speculative but rather that they are the most likely case based upon our information to date about bowhead behavior in the presence of industrial noise sources.

Response 8-10

The MMS studies efforts will continue to attempt to better determine the effects of industrial noise on bowhead whales. If you have a particular suggestion for a possible study, please submit it to the Alaska OCS Region office.

Response 8-11

Richardson et al. (1983) state that most cetaceans feed on pelagic fish or zooplankton, which--with the possible exception of very local areas--are generally considered to be largely unaffected by oil spills. Thus, the indirect effects of an oil spill on cetaceans via a reduction of a local food supply or bioaccumulation of petroleum hydrocarbons are unlikely to be a severe problem for most cetacean species. Additionally, because planktonic organisms lose their burdens of ingested oil within a few days, without retaining any residual fractions (Neff et al., 1972), the potential effect on bowheads would decrease rapidly after a spill event.

Response 8-12

Much has been learned about bowhead feeding behavior, feeding areas, and food resources through studies funded by the MMS, NMFS, the State of Alaska, the

2

Canadian Government, and the NSB. While much is yet to be learned, MMS believes that the past 8 years of aerial surveys of the Alaskan Beaufort Sea have provided us with information that is sufficient to identify the primary bowhead whale-feeding locations within the sale area and to allow a reasoned choice among the leasing options.

Response 8-13

The Secretary of the Interior has the option of deferring any or all of the deferral areas analyzed in the FEIS or areas proposed after consultation with the Governor of Alaska, pursuant to Section 19 of the OCSLA, as amended, from the Sale 97 proposed area.

Response 8-14

This concern is addressed in Response 21-23.

Response 8-15

More-severe potential effects on the Boulder Patch community are likely to come from construction activities and drilling discharges than from oil spills, for reasons cited in the analysis. Long-term deposition or erosion from nearby activities could cause a long-term effect to the Boulder Patch community, so the potential level of these effects has been increased from MODERATE to MAJOR.

Response 8-16

The analysis in Section IV.B.2 has been expanded to address this issue. It was concluded that although an oil spill contacting a delta region or near-shore area when char were aggregated could greatly effect those individuals, a population, although potentially significantly reduced, is not likely to be decimated (for reasons given in the analysis), and a local population should be able to rebound.

Response 8-17

This concern is addressed in Responses 7-14 and 8-2.

Response 8-18

The MMS believes the effects of oil development on bowhead whales would be MINOR as discussed in Section IV.B.5.b and in Responses 7-14 and 8-2. Consequently, cumulative effects on bowhead whales would be MODERATE.

Response 8-19

The worst-case analysis discusses the potential for loss of calves and a reduced reproduction rate in Section IV-I. The MMS believes that a MODERATE effects level represents a realistic worst case.

Response 8-20

The text has been amended to address this concern; see Section IV.B.9.b(1).

3

Response 8-21

Potential effects of an oil spill in the spring lead system on beluga whales could be different from such effects on bowhead whales--an oil spill is less likely to adhere to the smooth skin of beluga whales than the rougher skin of bowhead whales. Neither are beluga whales plankton feeders, nor do they have baleen plates; thus, oil is less likely to be ingested. Additionally, because the beluga whale population is greater than the bowhead population, the possible loss of some individual whales to the beluga population is not as likely to be as significant as it is to the bowhead population.

Response 8-22

This concern is addressed in Response 2-1.

Response 8-23

MMS recognizes the importance of subsistence hunting and fishing and classifies these activities as major scoping issues--Table I-D-1. Furthermore, MMS has analyzed potential measures to help eliminate or reduce the threat that oil exploitation poses to the subsistence resources. These measures include: (1) the Barrow and Kaktovik Deferral Areas; (2) the Orientation Program (No. 2), Protection of Biological Resources (No. 3), and Seasonal Drilling Restriction (No. 4) stipulations; and (3) Bird and Marine Mammal Protection (No. 1), Areas of Special Biological and Cultural Sensitivity (No. 2), and Subsistence Whaling and Other Subsistence Activities (No. 5) ITL's; Section II.B.1. Subsistence activities are adequately described in Section III.C.3 and are analyzed with regard as to how they might be affected by the proposed action in Section IV.B.9.

In addition, Section IV.B has been revised to address specific comments regarding subsistence that were received during review of the Sale 97 DEIS.

Response 8-24

Section IV.B.9.b(3) has been amended to address this concern.

Response 8-25

Section IV.B.2.a(1)(c) has been clarified to address this concern.

Response 8-26

The statement in question was drawn (and referenced) from Craig (1984a). It is important to note that this was a combined statement based on sheer numerical abundance or use by humans. The text in Section III.B.2 has been amended, however, to also stress the importance of broad whitefish.

Response 8-27

The text in Section III.B.2 has been amended to address these concerns by including information that has become available since publication of the DEIS.

Response 8-28

The text in Sections III.B.2 and .3 has been amended to reflect new information received since the DEIS was published.

Response 8-29

The effects of an oil spill in the Colville River Delta on Nuiqsut's subsistence harvest could be greater than NEGLIGIBLE. However, for Sale 97, there is a less than 2-percent chance of an oil spill of 1,000 barrels or greater contacting the delta during the open-water months. In addition, the low number of oil spills expected during the production life of the Sale 97 leases is unlikely to change the size of the regional fish populations enough to affect subsistence. Consequently, this analysis determined that NEGLIGIBLE effects on Nuiqsut's subsistence harvest are expected.

Response 8-30

Section III.C.3.b(3)(g) has been amended to address this concern.

Response 8-31

This concern is addressed in Response 7-13.

9

City of Nuiqsut
GENERAL DELIVERY
NUIQSUT, ALASKA 99789

December 17, 1986

Regional Director, Alaska OCS Region
Minerals Management Service
949 East 36th Ave., Room #110
Anchorage, AK. 99508-4302

Attn: Dick Roberts

Gentlemen:

The City of Nuiqsut on behalf of the Nuiqsut Whaling Association would like to submit a written comment due to the non-consideration of our communities whaling activities relating to the EIS for the proposed Oil & Gas Lease Sale 97 in the Beaufort Sea after a public hearing held in Nuiqsut, Alaska on December 11, 1986.

We would like our whaling area which starts at the mouth of the Colville Delta on over to Flaxman Islands with base station(s) at Cross Island to be deferred from any lease sale(s) in the area during fall whaling. 9-1

We would also request that any industrial activities in our area during the bowhead fall whaling migration be stopped, until such time as the Federal Government can study the bowhead whales and complete the current studies being conducted in the Beaufort Sea. 9-2

We realize that much of the area in which our whalers actively subsistence hunt for the bowhead has already been leased or selected for leasing but our community does not wish to be overlooked. We also have a immediate concern with the industrial noise associated with offsore activities which interferred in our 1986 fall whaling hunt. 9-3

The City of Nuiqsut extends our appreciation for the opportunity your panel gave the community during the public hearing held in Nuiqsut for comments and welcomes your panel back to the community for future public hearings concerning our area.

Respectfully,

Maggie Kovalsky

Maggie Kovalsky, Mayor
CITY OF NUIQSUT

MK:jo

cc: Nuiqsut City Councilmembers
Nuiqsut Whaling Captains Assoc.

Response 9-1

The Nuiqsut fall bowhead whale-hunting area was not proposed as a deferral area for the following reasons: (1) as shown in Figure V-1, part of the hunting area lies in waters that are within the State of Alaska's jurisdiction; and (2) some blocks lying within and some blocks near the hunting area already have been leased as a result of past State of Alaska and OCS oil and gas lease sales.

Response 9-2

The EIS analyzes a seasonal drilling restriction stipulation that would prohibit drilling during the bowhead-whale migration.

Response 9-3

This concern is addressed in Response 9-2.

1

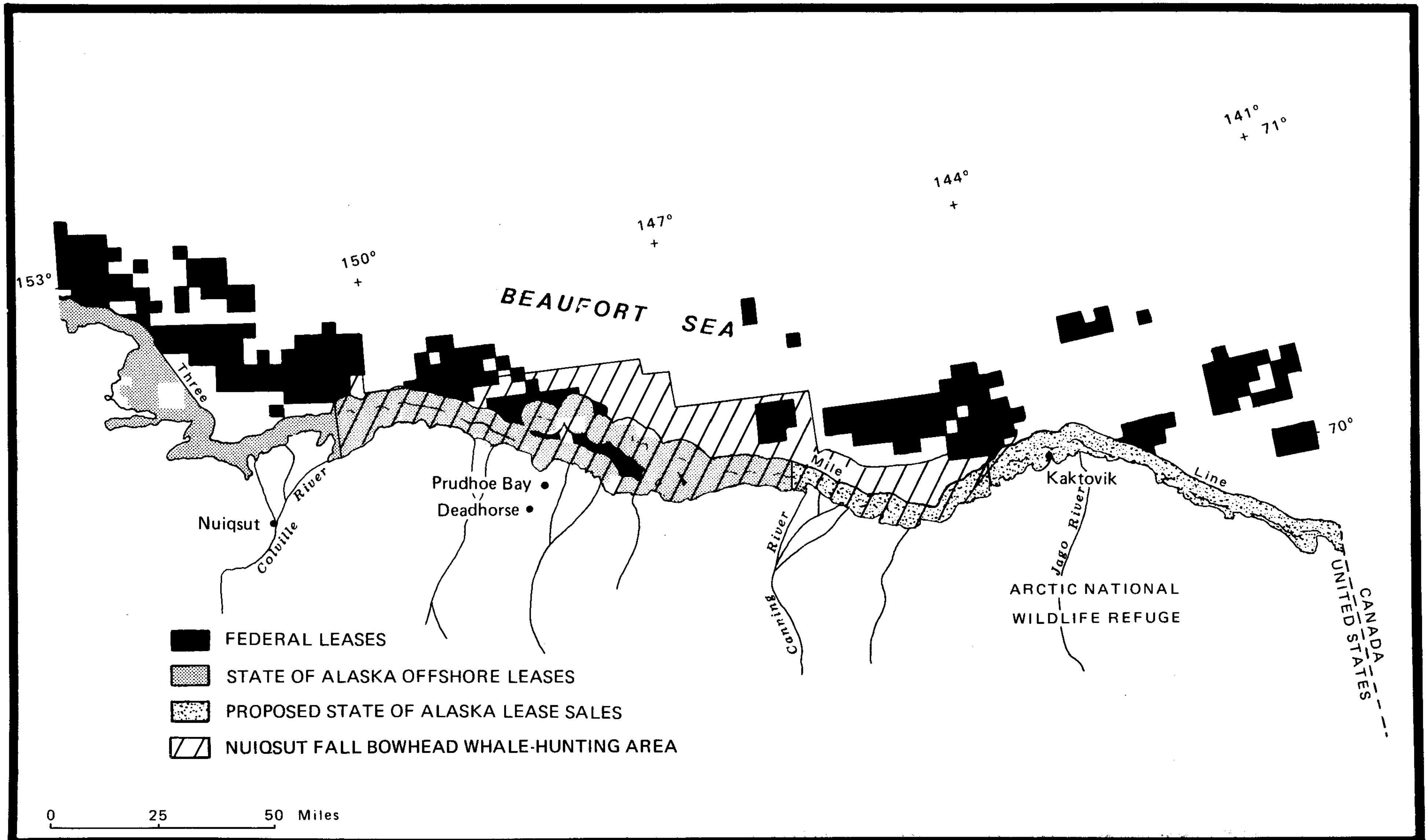

FIGURE V-1. NUIQSUT FALL BOWHEAD WHALE-HUNTING AREA

Alaska Oil and Gas Association

121 W. Fireweed Lane, Suite 207
Anchorage, Alaska 99503-2035
(907) 272-1481

January 6, 1987

Regional Director, Alaska OCS Region
Minerals Management Service
Attention: Dick Roberts
949 East 36th Avenue, Room 110
Anchorage, Alaska 99508-4302

Beaufort Sea Sale 97 DEIS

Gentlemen:

The Alaska Oil and Gas Association (AOGA) is a trade association whose member companies account for the majority of the oil and gas exploration, production and transportation activities in Alaska and the OCS offshore Alaska. Members of our organization have reviewed the Draft Environmental Impact Statement (DEIS) for the proposed Beaufort Sea Sale 97 (January, 1988) and AOGA is pleased to have this opportunity to comment.

AOGA supports Alternative I, making available for leasing 21.2 million acres in January, 1988. Alternatives II-VI would cancel, delay or delete acreage from the proposed sale area, actions we believe would not be in the best interest of the nation. Operations in adjacent sale areas have proven industry's capability to operate safely in the Beaufort Sea.

In general, the Minerals Management Service (MMS) has taken a very objective approach to evaluating the potential effects of industry operations in the Sale 97 area on the living resources of the region. For the most part, "effects" are summarized as MINOR or NEGLIGIBLE, with only a few effects considered to be MODERATE. Appraisals are fundamentally sound and we are in general agreement. The descriptions, discussions and assessments of possible or probable effects on living resources from a variety of influences (oil spills, construction, noise, boats, aircraft, etc.) appear to be objective in most cases.

The DEIS indicates that Stipulation No. 4 Seasonal Drilling Restrictions for Protection of Bowhead Whales from Potential Effects of Oil Spills will be applicable to the Sale 97 area. We urge the MMS to eliminate any such requirement as the stipulation is unnecessary. The DEIS acknowledges in Section IV.A. that significant oilspills in northern Alaska waters are extremely unlikely during exploration drilling. In fact, based on experience, a total of only 8.5 barrels are expected to be spilled, even if 20 exploratory wells are drilled. In addition to the negligible probability that Bowhead whales would be exposed to an oil spill, the effect of oil on Bowhead whales has been overstated in the DEIS. Dr. Joseph Geraci, a doctor of veterinary medicine and PhD in marine science, has conducted exhaustive research on the effects of oil on marine mammals. His work is regarded as the authoritative treatment on the subject. The following two reports by Dr. Geraci and Dr. David J. St. Aubin are attached to these comments, and we request they be included in the record for this DEIS: 10-1

"An Assessment of the Effects of Oil on Bowhead Whales, BALAENA MYSTICETUS"

"Effects of Offshore Oil and Gas Development on Marine Mammals"

Taken together, the low likelihood of oil spills occurring and minimal effects from oil contact support eliminating this stipulation.

Appendix J of the DEIS contains the 1983 Biological Opinion regarding bowhead whales in the Beaufort Sea as related to oil and gas exploration. On Page J-11 is a statement that the FEIS will contain a biological opinion for Sale 97. We request an opportunity to review and comment on this opinion before it appears in the Final EIS. 10-2

Attached are our detailed comments on the DEIS. If you have any questions on the attached material, please contact us.

Sincerely,

WILLIAM W. HOPKINS
Executive Director

WWH:MC6:683
Attachments 3

COMMENTS OF THE
ALASKA OIL AND GAS ASSOCIATION
ON
DRAFT ENVIRONMENTAL IMPACT STATEMENT
PROPOSED BEAUFORT SEA LEASE SALE 97

Summary Page

Please note the page number for this page should be xix, not xiv, as shown. 10-3

Summary Page, Second Paragraph

There is a reference here and in several other places in the DEIS (over and above those mentioned in the errata sheet) to the sale being held in July 1987. This sale is now scheduled for January 1988. It should be corrected throughout the DEIS. 10-4

Summary Page, Third Paragraph

The statement about the 1000 barrel oil spill comes across as "fact". Perhaps it could be clarified to say "Analysis indicates that there may be an 82% chance...". 10-5

When discussing potential exploration, development and production scenarios all references to the absolute, such as will, would, must, have to, etc., should be deleted and replaced by may, might, could, etc. We believe this is appropriate in that as you have stated on Page II-1, "there is no single correct development scenario" for this area. The content of the entire EIS should be consistent with this statement. 10-6

Table S-1, Summary of Effects

With regard to the fish and wildlife resources (Resource Categories 1 to 6), these appear to realistically identify the extent of effects that would occur under the most probable conditions.

With regard to subsistence (Resource Category 9), we believe the level of effects are overstated for Alternatives IV-VI. 10-7

Page II-2, First Paragraph

This paragraph acknowledges that the effects of development events would be overestimated using the accelerated MMS development schedule. The paragraph also states that the effects of some events may be based on total areas and populations affected or quantities produced rather than the rate of development. We urge the MMS to adopt a reasonable development schedule to avoid overstating probable effects. 10-8

Page II-2; b. Exploration Drilling Units, First Paragraph

Add to the end of this paragraph "(5) availability of drilling systems". The numbers and types of units to be used will depend in some cases on market availability. 10-9

Table II-A-1

The BEAUFORT SEA SUMMARY numbers should be reviewed as to consistency. For example, the total Beaufort Sea production should be from 1993-2014, not 1996-2011 as shown. 10-10

Page II-3, First Incomplete Paragraph

It should be noted in this paragraph that the SSDC is presently drilling an exploration well in Harrison Bay. 10-11

Page II-3, Last Paragraph

In the first line, replace the word "shallower" with "deeper". 10-12

Page II-6, a. Timing of Activities

In the first sentence, platform installation would commence in 1992, not 1993, according to Tables II-A-1 and G-4. 10-13

Page II-6, Fourth Paragraph

In lines 5 and 6, the statement is made that each well produces approximately 1,850 tons of drill cuttings. Based on Alaska experience, this amount is high by about 30 percent for a 12,000 ft well. The correct amount would be 1,300 tons. 10-14

Page II-6; b. Production Platforms, First Paragraph

In the second line, change "would be produced" to "may be produced". 10-15

Page II-7, First Complete Paragraph

In the third sentence change "would be constructed" to "can be constructed". 10-16

Page II-8; 4. Activities Associated with Oil Transportation--Mean-Case Resource Estimate, First Paragraph

Add to the end of this single-sentence paragraph "or to presuppose that pipelines are the preferred transportation system in all cases". 10-17

Page II-8, Second Paragraph

The first sentence should be rewritten to read: "Pipelines may be used to transfer hydrocarbons from the production systems to TAP Stations 1 or 3." 10-18

Page II-8, Fourth Paragraph

In the fourth sentence change "dredging depths" to "water depths" and "will be required" to "may be required". 10-19

Delete the last sentence. Stating that a dredge must be U.S. flag is prejudging. For example, if it can be shown that there is no existing U.S. equipment available, foreign flag equipment may be used. 10-20

This section should include a consideration of the fact that specific conditions at the time will dictate the final selection of construction methods and equipment. 10-21

Page II-9

The first complete sentence at the top of the page should be rewritten as: "However, as experience in other areas increases, plowing or dredging systems may be developed that can cut trenches more rapidly or deeper on a single pass, or both." 10-22

Page II-10, Fourth Complete Paragraph

The first sentence of this paragraph should be amended to read: "...will be elevated and/or buried in a manner....". 10-23

Page II-12, Second Paragraph

Add to the end of the third sentence "...or until existing stipulations are no longer deemed necessary.". 10-24

Table II-A-2

This table shows the mean-case resource estimates for Alternates I, IV, V and VI to be 650, 630, 560 and 620 MMBO, respectively. This listing implies that the Barrow deferral (Alternative IV) area contains 20 MMBO, the Kaktovik deferral area (Alternative V) contains 90 MMBO and the Chukchi deferral area (Alternative VI) contains only 30 MMBO. The latter area represents some 3.6 million hectares or about 42 percent of the total proposed sale acreage, while the mean implied resource estimate for this area is only 4.6 percent of the resource estimate for the entire proposed sale area. 10-25

The public might be misled to believe that deletion of these deferral areas might be insignificant because the areas are shown to contain only 3%, 4.6% or 14% of the estimated resources. It would be clearer to emphasize that preliminary estimates of economically recoverable oil in a frontier area are not the undiscounted resource estimate. Deletion of any blocks is not recommended because only the drilling of exploratory wells will determine if oil is indeed present and, given success, could have major resource potential.

Page II-16, Stipulation No. 4

AOGA submits that limitations such as Stipulation No. 4 are not necessary because the chance of any significant oil spill occurring is extremely remote. Over 6,000 exploratory oil and gas wells have been drilled in the U.S. offshore without a blowout which resulted in a major oil spill. Petroleum operations in the Beaufort Sea have resulted in no significant impacts. While industry's record is excellent, the regulatory scheme has been tightened even further. The Alaska OCS operating orders are the most exacting requirements found anywhere in the world. 10-26 Further, industry has developed and demonstrated the ability to respond adequately to oil spills that may occur in broken-ice conditions. This ability has been the subject of extensive analysis, including demonstrations of clean-up capability in broken ice. 10-27

Further, the effect of oil on Bowhead whales has been overstated. The skin of Bowheads, which is thicker than other marine mammal skin, is not likely to be adversely affected by contact with oil. Ingestion of oil by Bowheads, while possible, is unlikely to occur in volumes which would endanger the whale either because of toxicity or reduced food intake. Because of whale migration patterns, whales are not likely to be exposed to oil during conditions which could lead to serious harm. 10-28

Stipulation No. 4 is no longer necessary in the form presented in the Beaufort Sea Sale 97 draft EIS. Industry operations and research conducted in the Sale 87 area during the fall of 1986 have shown that such restrictive regulation is unnecessary to protect the Bowhead whale from oil spills, noise, etc., and to preserve subsistence usage. The attached documents provide additional scientific data supporting this statement. Based on technological and scientific evidence, Stipulation 4 should be dropped from the lease conditions. 10-29

Page II-19 Stipulation No. 5

This stipulation expresses a preference for pipelines for the transportation of crude oil. The selection of the means of transporting crude should be left flexible enough that all means can be considered equally at the time a transportation system is needed. Economics should be the primary criteria, as long as the option is environmentally acceptable. 10-30

Page III-2; (3) Mudslides

The information in this paragraph should be referenced. 10-31

Page III-8; Third Complete Paragraph

The velocities presented in the last sentence are inconsistent. 10-32

Page III-74

Change the last sentence to read: "...regional air quality still is within National and State...". 10-33

Chapter IV (general)

Discussions of development scenarios frequently mention Point Belcher and Bullen Point. None of the maps in the DEIS show any of these features. It would be helpful to the reader to locate these points on the large fold-out graphics. 10-34

Page IV-A-3 Oil-Spill-Risk Analysis

The inclusion of Canadian crude oil, produced and tankered to the west, is acknowledged as an extremely tenuous estimate of events on page IV-A-3, first incomplete paragraph. However, this "tenuous" estimate is carried forth in all presentations of cumulative case spill probabilities and it accounts for 50% or more of the probability of an oil spill. If an "extremely tenuous" factor has that much effect on the statistical results presented throughout the EIS, at a minimum, the factor's qualified significance should be noted by footnote wherever it plays a part in establishing the probabilities cited, i.e., in tables as well as the text. More appropriately, if the Canadian crude factor must be considered in the Sale 97 EIS, then it should be presented as a separate case of cumulative impact. This would clearly display the possible impact in the remote chance Canadian crude activity became a factor. At the same time, it would establish a cumulative impact case for use in the EIS which would represent the more likely case. 10-35

It is suggested that tables which include cumulative spill data be modified to include cases with and without the Canadian factor.

It is further suggested that the text include the figures from the case without the Canadian factor.

Page IV-A-7, Last Paragraph

A statement is made in the last paragraph on Page IV-A-7 which suggests that a significant mitigating factor for spills on land fast ice is dismissed in this EIS because the model which was used would not accept it. If it is true that the model cannot adequately portray a winter spill, then the authors should adjust the results appropriately with suitable correction factors.

Clearly an oil spill on solid, land fast ice is amenable to virtually complete clean-up leaving little to no threat of environmental damage. This fact should be considered in any statistical estimate of likely land contact of oil spilled on ice rather than being dismissed because a "more complex winter model" cannot handle this factor. Impacts of spills from platforms would be significantly reduced in land fast ice areas. This would have a major influence on determining the likelihood of land contact of a winter spill as displayed in Figure IV-9. That is, the near shore (more likely to be land fast ice) conditional probability isobars show the higher probability of land contact. If the oil from these spills could be removed before meltout, these isobar values would have to be reduced. 10-36

It is suggested that at some point in the development of the Combined Probabilities shown in Table IV-A-6 a factor which recognizes the diminished likelihood of land contact from oil spills on land fast ice be incorporated.

Page IV-A-17; 3. Constraints and Technology

This section is very repetitive of Sections II-A-2 through II-A-5 except for the greater consistency and fewer unnecessary constraints exhibited in Section IV-A-3. We recommend either deleting Sections II-A-2 through II-A-5 and replacing them with Section IV-A-3 or making all the sections more consistent in content. We note that the words "Basic Assumptions For Effects Assessment" are used in the sub-titles which introduce both Sections IV-A and II-A. We feel that if these basic assumptions need be repeated they should be reasonably consistent in each repetition. 10-37

Page IV-A-18; a. Sea Ice

For clarity, change the third sentence to read: "...the strength, size and shape of the ice...". Change the fifth sentence to read: "...well before the theoretical ice loads on the structure are reached.". Add to the end of the paragraph: "Sea ice can affect construction and resupply operations.". 10-38 10-39

Page IV-A-18, Fourth Complete Paragraph

In the last sentence delete the words "at least partially". 10-40

Page IV-A-19, First Paragraph

In the second sentence, delete "and then joined". Not all caisson-retained islands require a joining operation. 10-41

Insert a new third sentence to read: "The caissons are then filled with sand or gravel, constituting a caisson-retained island.". 10-42

Page IV-A-19, Fourth Paragraph

In the fifth sentence, the reference to water depth at the Prudhoe Bay spray ice island site is incorrect and should be changed from 9 meters to 7.6 meters. Additionally, this site was in Harrison Bay approximately 100 miles northwest of Prudhoe Bay. 10-43

Page IV-A-19, Last Paragraph

This paragraph should be updated to include 1986 information. Change to read as follows:

"Ice-strengthened drillships have been used to drill exploratory wells in waters deeper than 20 meters in the Canadian Beaufort Sea since 1976. On the average, drilling and testing a single well from a drillship in the Canadian Beaufort has taken nearly two drilling seasons. With assistance of icebreakers or icebreaking supply boats, the drillships were able to operate from about mid-July to mid-October or the first part of November. The drillships are designed to operate in waters that range from 15 to 303 meters. One of the Canadian ice-strengthened drillships was used to drill two exploration wells at a site 19 kilometers north of Flaxman Island in waters 32 meters deep and one exploration well about 32 kilometers northwest of Barter Island in the Alaskan Beaufort Sea. The drillship was supported by an Ice Class 3 icebreaking supply vessel and two ice-class supply vessels in the 1985 and 1986 summer drilling seasons." 10-44

Page IV-A-20, First Paragraph

Change second sentence to read: "...ages, concentrations and vectors.". 10-45

Page IV-A-21; (3) Transportation

We commend the MMS for recognizing that a combination of pipelines and tankers may be used for petroleum transportation. This broad approach should be maintained consistently throughout the EIS. 10-46

Page IV-A-21; (a) Offshore Pipelines, First Paragraph

In the last line delete "the best". 10-47

Page IV-A-24 Fifth Complete Paragraph

We suggest rewording activity (3) to: "placement and operation of bottom-founded gravity structures". We suggest rewording activity (4) to: "constructing artificial islands and berms". 10-48

Page IV-A-26; (3) Waves, Currents and Storm Surges -- Flooding and Erosion

In the third sentence change "an extreme" to "the result of a". 10-49

Page IV-B-11, Fourth Paragraph

The statement that epibenthic organisms have a moderately high probability of being contacted by an oil spill is contradicted by the next sentence that says the probability of oil contacting the subtidal sediments is low. 10-50

Page IV-B-24; (4) Construction Activities, First Paragraph

In the text there are considerable assumptions that there will be cumulative effects from causeways. There is no evidence that causeways have had impacts on fish populations. These assumptions seem to arise from personal communications and are not supported by the extensive data base collected on Beaufort Sea causeways.

While there may be some localized distributional changes of some fish, there is no evidence that the West Dock Causeway has affected the "abundance of anadromous fishes in the Beaufort Sea". There are no data to support a theory that young-of-the-year arctic cisco traditionally overwinter first in the Sag River then in the Colville River. In fact, in 1985, with two causeways in place, these first year arctic ciscos made it all the way to the Colville River. 10-51

The salinity-temperature alterations due to the Prudhoe causeways are due to the changes in current patterns, are localized and transient, and depend on which way the wind blows (current being a function of wind in these nearshore shallow waters). However, the wording in this Draft EIS implies something more substantial than this. Several years of study (including the 1981-84 Prudhoe Bay Waterflood studies, 1985 Endicott studies, and 1985 Colville River fish studies) have shown that fish of all sizes (from young-of-the-year to large, sexually mature, adult anadromous fish) are able to survive and migrate through the area.

Page IV-B-90; Third Paragraph

The second sentence states that a pipeline and roads would disturb caribou. There are already major pipelines from Oliktok Point to TAP and another wouldn't cause any more disturbance than the others. 10-52

Page IV-B-93; Last Paragraph

The statement "Since the scenario assumes that a pipeline from Oliktok Point to the TAP would be offshore..." contradicts the statement on Page II-9, third paragraph, which specifies onshore pipeline from Oliktok Point to TAP. 10-53

Page IV-B-105; (c) Energy Facilities (6 AAC 80.070)

We must object to the second sentence of this section which states: "Because of the unique terrain, ownership patterns, and land use patterns of the NSB, not all 16 policies are appropriate.". This curious interpretation of the Alaska Coastal Management Program is consistently followed throughout this section to the second paragraph on page IV-B-113, as a number of oil and gas activities are held to be "in conflict" with various policies of 6 AAC 80.070. We offer the following comments:

1. 6 AAC 80.070 lists 16 standards (not "policies"). 10-54

2. These standards are not prohibitions, but are clearly modified by 6 AAC 80.070(b), which states: "The siting and approval of major energy facilities...must be based, to the extent feasible and prudent, on the following standards:". This leaves latitude for the state to negotiate siting plans and mitigation procedures with a developer. Arctic oil and gas development has proceeded under the ACMP since its inception in 1978, and we see no reason for future development to deviate from that course.

Page IV-B-112; First Full Paragraph

The second sentence states: "Causeways extending offshore could increase risks to anadromous fishes to major."

We believe that statement to be erroneous. It has been ARCO's and Standard's experience that the causeways at West Dock and at Endicott have not prevented the migration of fish, nor have they caused any detectable mortality. The only DEIS reference in support of the subject sentence is personal communication from Craig Johnson of NMFS, who observed an increase of arctic cisco in Prudhoe Bay following construction of the West Dock causeway (IV-B-24). Rather than "stalling" fish east of the causeway, an alternative explanation is that perhaps a local, more attractive habitat has been created by the causeway, and that the arctic cisco population has actually increased. 10-55

Page IV-B-122; Fourth Paragraph

We recommend the statement "water quality criteria cannot be exceeded at greater than a 100 meter distance from the discharge point" should be revised to "water quality criteria must be met at the edge of the mixing zone established by the EPA issued discharge permit". 10-56

Page IV-D-1 Alternative III - Delay of Sale

Industry has the technology and equipment available now to safely explore the Beaufort Sea and is confident that it can do so without significant adverse environmental effects. Proceeding on schedule with this lease sale in 1988 will present no more hazard to the environment than would waiting until 1990 to conduct the sale as is considered in Alternative III. The DEIS states "Although additional information would be useful, MMS has successfully used the existing data base in the past to provide an adequate analysis of the consequences of oil and gas activities...". It is unlikely that any significant changes in the analysis or conclusions would result from new information which would be collected during this two-year period. Therefore, we find no compelling reason to delay this sale, which has already been postponed five times.

Pages IV-H-1 through 3; Section IV H. Unavoidable Adverse Effects

This section should not include the effects of highly unlikely worst case incidents as "unavoidable adverse effects". In April, 1986, NEPA/EIS guidelines were changed from requiring worst case assessment to that of "most likely to occur". Examples of worst case are found in H. 1., 2. and 6. where conclusions of MODERATE effects are reached. 10-57

Page IV-H-3; 14. Air Quality

It is not clear how the conclusion was reached that there is "MODERATE" degradation of air quality in the Unavoidable Adverse Effects section given in Part H. The alternatives discussed may cause "MINOR" degradation of air quality as expressed in Parts B-G of Section IV (See Page IV-B-127). The Unavoidable Adverse Effects of air quality degradation should also be considered as "MINOR". 10-58

Page G-1, Table G-1

The Schedule for the Low-case does not provide for the drilling of exploratory wells. 10-59

Page G-4, Table G-8

The resource estimates for the BF/Beaufort Sea Sale held in 1979 and OCS Sale 71 should be reduced to reflect exploration activities since the sales. 10-60

trl2:1208

Response 10-1

MMS acknowledges and is encouraged by industry's efforts to explore in a safe and environmentally sound manner such as during the 1986 fall bowhead migration. Furthermore, the EIS acknowledges the low probability of bowheads contacting spilled oil or being harmed through such contact. However, there remains a small probability that a major oil spill could occur and contact bowhead whales. Should bowheads be trapped or linger in an area--such as a lead or polynya--into which a large volume of crude oil or refined product is spilled and thus be forced to repeatedly surface through this oil, there is a potential for harm to these individuals.

The bowhead is of utmost importance to Native subsistence hunters and is an endangered species. As such, any unauthorized take is a violation of the Marine Mammal Protection Act and Endangered Species Act of 1973, as amended; and, as noted in Section II.B.1.a(2), ITL Number 1, the term "take" has been defined to include harm. Adoption of Stipulation Number 4 would provide a means of protecting the bowhead whale by eliminating the risk of an oil spill contacting and potentially harming bowhead whales as they migrate through Alaska waters.

Final reports are being prepared to document the monitoring effects for bowhead whales in the vicinity of exploratory-drilling operations in the Beaufort Sea during 1985 and 1986. The information in these reports will be used by (1) the MMS to analyze the effects of exploration drilling on migrating bowhead whales and evaluate the effectiveness of mitigating measures such as Stipulation Number 4 in protecting the whales and (2) the Secretary of the Interior in considering what measures, if any, are necessary to protect the whales and should be included in any lease agreements.

Response 10-2

This concern is addressed in Response 7-13.

Response 10-3

The referenced page number has been revised.

Response 10-4

The sale date has been revised.

Response 10-5

The text in the Summary has been amended to address this concern.

Response 10-6

Because verbs assume a different mood when they are used conditionally and/or subjunctively, the verbs will, would, must, have to, etc., do not necessarily connote a reference to the absolute. Strunk and White (1979), for example, advise saving conditional use of the auxiliaries would, should, could, may, might, and can "for situations involving real uncertainty." See also Bernstein (1981), who states that "The subjunctive mood of a verb is the form associated with condition, command, wish, doubt, desire, possibility, etc."

The subjunctive mood is not popularly used today as a form evidenced by an identifiable verb change, with four exceptions. The latter of these--to express conditions that are merely hypothetical (Bernstein, 1981)--is a necessary usage in EIS writing.

A potential for error is an inconsistency of moods in the protasis (condition) and apodosis (consequence). However, the referenced statement on page II-1 and other similar statements and disclaimers throughout the EIS (see especially the disclaimer on the inside front cover) adequately set the stage, or condition, for the discussions of assumed scenarios (and also potential environmental consequences).

Response 10-7

The levels of effect for subsistence harvests are different than those for biological resources because of different methods of analyses. The analysis of biological resources examines the effects on the entire population of the resource, while the subsistence-harvest analysis only examines the effects on a potentially small portion of the population--these effects are often localized. If an oil spill were to occur in the only place where a resource is harvested and during the primary month when a resource is harvested, then that harvest could not occur for the entire year; this would be a MODERATE effect. If this happened more than 1 year, the effect would be MAJOR. Thus, even though an oil spill might not have more than MINOR effects on the biological population, it could have a higher level of effect for subsistence harvests. Similar logic applies to noise and traffic disturbance, construction activities, and facility sitings. Within the subsistence harvests, these levels of effects also vary according to whether or not the harvest occurs during a short timeframe or throughout the year, in many places, or in high or low numbers.

Response 10-8

MMS has revised the estimated schedule of events for petroleum exploitation in the Sale 97 leased areas. The scenarios are now based on a 12- to 13-year period between the beginning of exploration and the start of production. Tables II-A-1 and II-A-2; IV-A-1; and Appendix G, Tables G-1, 2, 3, 5, 6, and 7 have been revised accordingly.

Response 10-9

Section II.A.2.b has been amended to address this concern.

Response 10-10

The information in Table II-A-1 has been amended to reflect a revised schedule of activities.

See Response 10-8.

Response 10-11

The text in Section II.A.2.b has been revised to address this concern.

Response 10-12

Section II.A.2.b has been revised to address this concern.

Response 10-13

The text has been amended to reflect a revised schedule of activities.

See Response 10-8.

Response 10-14

The quantity of cuttings from drilling exploration and delineation wells, Section II.A.2.d, and production and service wells, Section II.A.3.a, has been revised; see Table II-A-1.

Response 10-15

This concern is addressed in Response 10-6.

Response 10-16

This concern is addressed in Response 10-6.

Response 10-17

This concern is addressed in Section II.A.1.

Response 10-18

This concern is addressed in Response 10-6.

Response 10-19

Dredging depth refers to the depth below the water surface that the dredge head can be extended and cut into the seafloor. Water depth is the depth from the water surface to the seafloor surface.

Also, see Response 10-6.

Response 10-20

The text in Section II.A.4 has been revised to address this concern.

Response 10-21

This concern is addressed in Section II.A.1.

Response 10-22

Section II.A.4 has been amended to address this concern.

Response 10-23

Section II.A.4 has been amended to address this concern.

Response 10-24

The text in Section II.B.1.c has been revised to address this concern.

Response 10-25

The information presented in Table II-A-2 and the discussion of the potential oil resources for the deferral alternatives notes that the quantities mentioned are estimates. Unfortunately, the presentation of any number associated with a process requiring subjective judgments and estimates can be misleading to those not familiar with the methodology. An attempt to alert the reader to the uncertainty of these estimates is presented in Section II.A.1.

Response 10-26

This concern is addressed in Response 10-1.

Response 10-27

Industry has demonstrated the capacity to mobilize and deploy cleanup equipment in broken ice within the landfast-ice zone in summer, in open water in summer, and on landfast ice in winter. However, industry cannot guarantee that spilled oil would be consistently and quantitatively recovered in real spills--for example, no oil was recovered from the Minuk I-53 exploration spill of 2,440 barrels in September 1985 (Birchard and Nancarrow, 1986) in the Canadian Beaufort Sea.

Response 10-28

This concern is addressed in Response 10-1.

Response 10-29

This concern is addressed in Response 10-1.

Response 10-30

The wording in this stipulation does not prohibit the use of other methods of hydrocarbon transportation or the use of offshore loading, providing that the conditions identified in the stipulation cannot be met. Economic feasibility is one of those conditions. The referenced wording, ". . . following the

development of sufficient pipeline capacity," as well as other parts of the stipulation, point out what will be required if pipelines are utilized. The first paragraph states that pipelines will be required "if . . . technologically feasible and environmentally preferable . . ." The last sentence of this paragraph states, "In selecting the means of transportation [of hydrocarbons], consideration will be given to recommendations of the Regional Technical Working Group . . . ." The above wording recognizes that an option is available to the operator regarding the type of hydrocarbon transportation that may be used.

Response 10-31

Section III.A.1.b(3) has been amended to address this concern.

Response 10-32

Section III.A.3.a(3) has been amended to address this concern.

Response 10-33

The text in Section III.D.6 has been clarified.

Response 10-34

Point Belcher and Bullen Point have been added to Graphic 6.

Response 10-35

Only 18 percent of the oil resource estimated to be in the Canadian Beaufort Sea/MacKenzie Delta area is assumed to be tankered through the U.S. Beaufort Sea. This Canadian tankering to the west is no longer a tenuous assumption (see Oil and Gas Journal, 1987). In 1986, the Canadian oil industry tankered 350,000 barrels of crude past Point Barrow, enroute to Japan. Starting in 1988 and continuing until a pipeline south is completed, Canadian tankers will make about seven trips each year during a 5-month "open-water" window, carrying crude to market in Asia. In the oil-spill-risk analysis, Canadian tankering contributes only 2.6 percent of the spills of 1,000 barrels or greater in the cumulative case. Almost all of the spill risk from Canadian activities in the cumulative case is from production and piping of oil in Canadian waters. The trajectory analysis indicates that these platform and pipeline spills would enter U.S. waters. A footnote has been added to Table IV-A-4 to clarity that tankering contributes little spillage to the Canadian portion of the cumulative case.

Response 10-36

The oil-spill-trajectory model simulates movement of the center of mass of oil slicks and adequately simulates winter trajectories. Consideration of cleanup of oil spills in a trajectory model is secondary to the establishment of the best and most accurate simulation of oil movement. Incorporation of the assumption that platform spills in landfast ice would be cleaned up prior to the open-water season would reduce effective spillage in the oil-spill-trajectory model by 0.07 spills, a decrease of less than 4 percent. That the differing treatments of platform spills in landfast ice in the EIS's for Sales 97 and 87 have negligible effect on combined probabilities has been clarified in Section IV.A.1.c.

Response 10-37

In Section II.A, the scenarios that may be used to explore, develop and produce, and transport the oil resources of the Sale 97 area are discussed. Based on the resource estimates, the scenarios include an estimate of the level of activities, such as the number of exploration wells that may be drilled, the number of production platforms installed, and the length of pipelines installed. The scenarios also include a table showing a hypothetical schedule of events. Section IV.A.3 is primarily a discussion of those factors of the physical environment that may constrain petroleum exploitation in the Beaufort Sea Planning Area. A discussion of the technologies that have been or may be used in the Beaufort Sea has been added to acquaint the reader, who may not be knowledgeable about the area, with the technologies and strategies being developed to overcome the constraints.

Response 10-38

The text in Section IV.A.3.a has been revised to address this concern.

Response 10-39

The first sentence in Section III.A.3.a notes that sea ice is the principal environmental factor affecting offshore development of petroleum resources in the planning area. Construction and resupply operations are assumed to be part of the offshore development of the resources.

Response 10-40

Section IV.A.3.a(1) has been amended to address this concern.

Response 10-41

Section IV.A.3.a(1) has been amended to address this concern.

Response 10-42

Section IV.A.3.a(1) has been amended to address this concern.

Response 10-43

The information on the test spray-ice islands is correct according to the reference cited. Additional information on the spray-ice island in Harrison Bay has been added to the discussion in Section IV.A.3.a(1).

Response 10-44

Section IV.A.3.a(1) has been amended to address this concern.

Response 10-45

Section IV.A.3.a(1) has been amended to address this concern.

Response 10-46

Tankers are mentioned in Section IV.A.3.a(3)(b) as a possible alternative oil-transportation system to the pipelines.

Response 10-47

Section IV.A.3.a(2) has been amended to address this concern.

Response 10-48

Section IV.A.3.b(1) has been amended to address this concern.

Response 10-49

The text in Section IV.A.3.b(3) has been amended to address this concern.

Response 10-50

Section IV.B.1.b(1) has been amended to address this concern.

Response 10-51

The text in Section IV.B.2(b)(4) has been amended to address the concerns stated and to include information that has become available since publication of the DEIS.

Response 10-52

Further discussion of the disturbance of caribou that might result from the pipeline from Oliktok Point to TAP has been added to Section IV.B.9.b(2). It should also be noted that this referenced paragraph states that "such disturbance would last only during the construction season."

Response 10-53

Section IV.B.9.c(2) has been amended to address this concern.

Response 10-54

The standard for energy-facility siting in Section IV.B.11.a(2)(c) has been clarified as suggested.

Response 10-55

Conclusions for biological and sociocultural effects used in the section on land use and coastal management programs is derived from other sections in this EIS. Support for the statement that causeways pose a threat to anadromous fish is found in Section IV.B.2.b(4).

Response 10-56

The text has been amended as suggested--see Section IV.B.14.a.

Response 10-57

The analyses objected to in Sections IV.H.1 and 2 are not worst-case assessments, rather they are extensions of the most likely case that include events or effects somewhat less likely to occur because of timing of events or particular locations of spills or other activities.

Section IV.H.6 does not conclude that MODERATE unavoidable effects would occur but instead only states that MODERATE effects are possible. The conclusion is that MINOR effects are likely.

Response 10-58

The text in Section IV.H.14 has been corrected to change "MODERATE" to "MINOR." The use of the word "MODERATE" was an oversight in this case.

Response 10-59

As noted in Table G-1, the schedule does provide for the drilling of two delineation wells.

Response 10-60

The resource estimates shown in Appendix G, Table G-8, for each of the three previous Beaufort Sea lease sales--BF, 71, and 87--are the mean-case resource estimates used in the analysis of the proposed action for each sale's FEIS. As noted in Table IV-A-7, all previous Federal offshore lease sales in the Beaufort Sea are considered to be a single major project in the cumulative-effects assessment; thus, the resource estimates are not revised for each previous sale. However, the resource potential for all the areas offered for leasing in Sales BF, 71, and 87 is estimated to be 600 MMbbls; Appendix G, Table G-8.

11

AMOCO

Amoco Production Company
Denver Region
1670 Broadway
P.O. Box 800
Denver, Colorado 80201
303-830-4040

Gary W. Chipman
Regional Land Manager

December 31, 1986

Mr. Alan Powers
Regional Director, Alaska OCS Region
Minerals Management Service
949 East 36th Avenue, Room 110
Anchorage, Alaska 99508-4302

Written Comments
Draft Environmental Impact Statement
OCS Sale 97
Beaufort Sea, Alaska

Dear Mr. Powers:

Thank you for affording Amoco Production Company the opportunity to comment on the Draft Environmental Impact Statement (DEIS) for OCS Sale 97. We look forward to continued participation in the pre-sale planning process for this and other Alaska OCS sales.

The OCS Lands Act Amendments of 1978 call for the expeditious assessment and development of the oil and natural gas resources of the Outer Continental Shelf. Amoco Production Company regards area-wide OCS Lease offerings and efficient exploratory drilling as fundamental components of a policy designed to implement the purposes and objectives of this statute. The Minerals Management Service can help provide for a secure domestic resource base by ensuring that all areas of hydrocarbon potential are offered for leasing and by providing for the conduct of efficient exploratory drilling.

Amoco supports the MMS proposal to offer all 3,930 blocks for leasing at OCS Sale 97 in January, 1988 (DEIS Alternative I, The Proposal). The cancellation, delay, and sub-area deferral options (Alternatives II-VI) detract from implementation of the OCS Lands Act Amendments mandate and fail to take into account our industry's record of conducting operations in an environmentally sound manner.

Development of hydrocarbon resources in the Beaufort Sea will require many years of work. The Minerals Management Service should encourage efficient exploration in an effort to limit these long lead times. In this regard, Amoco believes that perpetuating the constraints contained in proposed Stipulation No. 4 "Seasonal Drilling Restriction for Protection of Bowhead Whales from Potential Effects of Oil Spills" would seriously hinder efficient exploratory drilling. The requirements of existing OCS operating 11-1 orders, together with the harsh and remote environment, demand that only the best available and safest technology be used in Alaskan offshore drilling operations. Stipulation No. 4 should therefore be deleted from Sale 97 leases.

In the extremely unlikely event that a significant spill would occur, we still maintain that Stipulation No. 4 is unnecessarily restrictive. Recent research concludes that the potential effect of oil and noise on bowhead whales has been overstated (see Attachments 1 and 2). Drs. J. R. Geraci and D. J. St. Aubin are authorities on the subject of marine mammals. This research was provided to the State of Alaska, Department of Commerce, and Department of the Interior in 1985 and early 1986. Industry exploration activities in the Beaufort Sea in recent years have been conducted in an environmentally safe manner with no apparent adverse effects to the bowhead whale or subsistence hunting. During exploratory drilling and seismic operations in the Beaufort Sea this past season (1986), the villages of Kaktovik and Nuiqsut were successful in taking four bowhead whales (of their total allocation of five).

It is important to note that Stipulation No. 4 was predicated on a 1983 biological opinion which has been rendered out-of-date by recent research efforts and which did not conform with the consultation requirements of Section 7 of the Endangered Species Act. 11-2

In conclusion, Amoco Production Company strongly supports offering the entire sale area for leasing (DEIS, Alternative I). We also consider proposed Stipulation No. 4 to be an unnecessary impediment to exploratory drilling, based on our industry's safety record and on the findings of recent research, and recommend its deletion from Sale 97 leases.

Very truly yours,

Gary W. Chipman

Gary W. Chipman

TRM/drh

Attachment

EFFECTS OF OIL ON BOWHEAD WHALES

The attached paper makes it clear that the effect of oil on bowhead whales has been overstated. It concludes that whales can be expected to avoid oil spills, and to avoid breathing toxic fumes. The skin of bowheads, which is thicker than other marine mammal skin, is not adversely effected by contact with oil and/or petroleum and will protect the animal. Ingestion of oil by bowheads, while possible, is unlikely to occur in volumes which endanger the whale either because of toxicity or reduced food intake. Because of whale migration patterns, whales are not likely to be exposed to oil during conditions which could lead to serious harm.

Dr. Joseph Geraci, a doctor of veterinary medicine and PhD in marine sciene, has conducted exhaustive research on the effects of oil on marine mammals. His work is generally regarded as the authoritative treatment of the subject.

At Amoco's request Dr. Geraci and his associate David St. Aubin have synthesized the existing knowledge to determine, to the extent known, the effect of oil on bowhead whales. That paper follows. At the conclusion of the paper are detailed <u>curriculum vitae</u> of Dr. Geraci and Mr. St. Aubin.

<u>Response 11-1</u>

This concern is addressed in Response 10-1.

<u>Response 11-2</u>

This concern is addressed in Response 10-1.

12

ARCO Oil and Gas Company
Post Office Box 100360
Anchorage, Alaska 99510-0360
Telephone 907 265 6123

James M. Posey
Manager
Issue Advocacy

January 5, 1987

Regional Director
Alaska OCS Region
Mineral Management Service
949 E. 36th Ave., Room 110
Anchorage, AK 99508-4302

ATTN: Dick Roberts

RE: Beaufort Sea - Sale 97
Draft Environmental Impact Statement (DEIS)

Dear Mr. Roberts:

ARCO Alaska, Inc. has reviewed the above referenced document and provides the following comments for your review and consideration.

ARCO would like to commend the Mineral Management Service for its objective approach in evaluating potential effects of industry operations in the Sale 97 area.

We strongly support Alternative I, the proposed action described in the DEIS, and urge the Secretary to proceed with this OCS offering as currently scheduled for January, 1988.

The industry's record clearly demonstrates that the activities resulting from this proposed lease offering (as outlined in Alternative I) can be conducted without a significant disruption or interference with the multiple use of the OCS. Our record in the Gulf of Mexico, and offshore California and Alaska supports the conclusion that oil and gas exploration and development activities will not result in significant impacts to the biological, cultural, aesthetic, or socio-economic resources of this OCS area or adjacent state-owned coastal waters.

It is abundantly clear from the DEIS that the No Sale alternative would not be in the best interests of the nation. This alternative would contribute absolutely nothing to the need for increasing the nation's oil and gas reserves and production, and reducing our dependence on unstable foreign sources of crude oil. In this regard, development of alternative energy sources cannot be expected

ARCO Alaska, Inc. is a Subsidiary of AtlanticRichfieldCompany

to make a significant contribution to the nation's energy supply in the foreseeable future since most are not feasible at this time and may not be feasible during the estimated life of this production area.

With respect to the mean case resource estimates contained in the DEIS, we believe these imply that in the deferral alternatives (IV, V, and VI), the areas of deferral contain only a small amount of undiscovered reserves. This may suggest to some that by deferring an area, only a little petroleum resource is given up in return for environmental protection. However, due to the exploration unknowns, it is well within the range of possibilities that much, if not most, of the petroleum resources could lie within the areas proposed to be deferred. 12-1

ARCO Alaska, Inc. also participated in the development of the comment being submitted by the Alaska Oil and Gas Association and fully supports the content of that commentary.

If you have any questions or require additional information, please let us know.

Sincerely,

J. M. Posey

JMP/RO511:sm

Response 12-1

The resource values given for each of the three deferral alternatives are, as noted in Section I.A.1, only estimates. The quantity of oil that may be present in any part of the proposed sale area will be unknown until exploration and delineation wells are drilled. Thus, the amount of oil that may be present in any of the proposed deferral areas may be more or less than the amount inferred from resource estimates for the deferral alternatives.

The Secretary of the Interior has the option of deferring from the Sale 97 proposal area any or all of the deferral areas analyzed in the FEIS or areas proposed after consultation with the Governor of Alaska, pursuant to Section 19 of the OCSLA, as amended.

13

Chevron

Chevron U.S.A. Inc.
6001 Bollinger Canyon Road, San Ramon, California
Mail Address: P.O. Box 5050, San Ramon, CA 94583 0905

J.J. Anders
Manager, Alaska Division
Land Department, Western Region

RECEIVED
DEC 30 1986
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

December 30, 1986

Draft Environmental Impact
Statement (DEIS),
Proposed Outer Continental Shelf,
Beaufort Sea Lease Sale 97

Regional Director
Alaska OCS Region
Minerals Management Service
Attention: Dick Roberts
949 East 36th Avenue, Room 110
Anchorage, AK 99508-4302

Gentlemen:

Chevron U.S.A. Inc. appreciates this opportunity to make written comments on the subject DEIS which was issued in November, 1986.

Chevron supports Alternative I as the most rational approach to dealing with our country's energy demands of the 1990s and beyond. Chevron also notes that the close cooperation with both local and national government agencies on the North Slope is a record of which the petroleum industry can be proud. This cooperative spirit ensures that the important ecological and sociological values will be protected by the safeguards detailed in Alternative I.

Chevron does believe that a more flexible set of Bowhead Whale drilling stipulations can be adopted for OCS Sale #97. During the summer of 1986, the cooperative effort by the Oil/Whaler's Working Group allowed drilling to proceed above the oil reservoirs without endangering or disrupting the Bowhead Whale migration. In addition, the continuing Bowhead Whale studies indicate that drilling noise is much less disturbing to migrating Bowheads than originally thought. 13-1

Chevron strongly opposes both Alternatives II and III based on their potential damage to the nation's economic and security interests. Environmental risks, under the strict guidelines outlined in the Sale #97 DEIS, are minimal compared to the harm to the national interests if the sale is cancelled or delayed.

Chevron considers Alternative IV, the "Barrow Deferral Alternative," excessive. Proposed MMS rules regulating seismic and drilling activity during whale migrations are strict and can be altered if necessary. The level of exploration activity and development will necessarily be stretched out over many years. Past experience suggests that little or no effect on subsistence hunting will occur with the normal safeguards. 13-2

Alternative V, the "Kaktovik Deferral Alternative," is also an extreme and impractical approach. Normal procedures outlined in the DEIS for Alternative I are adequate to ensure the survival of subsistence hunting. In addition, many nearby offshore blocks are already under lease from previous sales. Therefore, exploration and development activities will necessarily impinge upon the proposed Kaktovik deferral area whether the deferral area is adopted or not. The country would potentially lose energy resources under Alternative V. It is even more difficult to justify Alternative V in view of planned State Sale #55 in 1988. 13-3

The weight of the evidence in the present DEIS strongly indicates that Alternative VI, the "Chukchi Deferral Alternative," has little or no ecological justification. After careful analysis. Chevron agrees with this conclusion. 13-4

To sum up Chevron's position, the history of exploration and development on the North Slope (and the Canadian's MacKenzie Delta) show that the petroleum industry can exist in harmony with the Arctic environment and is sensitive to the concerns of the native peoples. The potential hydrocarbon resources beneath the Beaufort Sea could be an important addition to the nation's economy and security.

Thank you for this opportunity to comment on the DEIS for proposed OCS Sale #97.

Very truly yours,

JJ Anders /bet

JJA:blp

Response 13-1

This concern is addressed in Response 10-1.

Response 13-2

The deferral areas and mitigating measures are proposed based on information obtained and environmental concerns expressed during the scoping process and identified Section I.A.5.

Since the bowhead whale is listed as endangered under the Endangered Species Act of 1973, adverse effects from oil and gas exploration activities on bowhead whales must be avoided. The proposed seasonal drilling restriction, which will help avoid potential adverse effects on bowhead whales and conforms with the NMFS biological opinion of reasonable and prudent alternatives, would add an extra measure of protection to the endangered bowhead whale. Without the measure, there would be a greater chance of potentially detrimental oil-spill/whale interactions.

The Secretary of the Interior has the option of deferring from the area eventually offered for leasing any or all of the deferral areas analyzed in the FEIS or areas proposed after consultation with the Governor of Alaska, pursuant to Section 19 of the OCSLA, as amended.

Response 13-3

This concern is addressed in Response 13-2.

Response 13-4

As noted in Section I.D.4.d, the Chukchi Sea shelf was proposed as a deferral area during the scoping process. The effects of deleting the Chukchi Deferral Area from the Beaufort Sea Planning Area are analyzed in Section IV.G.

The Secretary of the Interior has the option of deferring from the Sale 97 proposal area any or all of the deferral areas analyzed in the EIS or areas proposed after consultation with the Governor of the State of Alaska, pursuant to Section 19 of the OCSLA, as amended.

1

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COMPANY, U.S.A.
POST OFFICE BOX 4279 • HOUSTON, TEXAS 77210-4279

EXPLORATION DEPARTMENT
OFFSHORE ALASKA DIVISION

December 31, 1986

Draft Environmental Impact
Statement
Sale 97

Minerals Management Service
Regional Director
Alaska Region
949 East 36th Avenue
Anchorage, Alaska 99508-4302

Attention: Mr. Alan D. Powers

Gentlemen:

Exxon Company, U.S.A., a division of Exxon Corporation, is pleased to have the opportunity to review and comment on the Draft Environmental Impact Statement (DEIS) for the proposed Beaufort Sea Lease Sale 97 (January 1988). We support Alternative I (the Proposed Action), and urge the Secretary to proceed with this OCS offering as currently scheduled. We believe that the oil and gas industry's experience has shown that exploration and production activities can be conducted without significant adverse impact to the arctic environment.

Exxon commends the Minerals Management Service (MMS) for its consideration of the potential benefits, as well as adverse consequences, of post lease sale activities. We offer the following comments on issues of concern to us. In addition to these comments, Exxon participated in the preparation of the comments of the Alaska Oil and Gas Association (AOGA), and we support those comments.

Exploration and Development Schedules (Table II-A1)

The exploration and development schedules in the DEIS seem to be somewhat optimistic given the current state of the industry and the demanding arctic environment. The eight year period between exploration drilling and resulting production does not allow for five to ten years of delineation drilling designed to gain reservoir data and demonstrate the commercial viability of the project. Another factor which might add to the timetable would be the availability of various types of drilling structures, and their ability to conduct year-round or seasonal operations. A more probable development schedule would call for 12-15 years from the date of the sale to the date of first production. 14-1

A DIVISION OF EXXON CORPORATION

Lease Stipulation No. 4 - Seasonal Drilling Restriction for Protection of Bowhead Whales from Potential Effects of Oil Spills (Page II16)

Exxon continues to oppose the imposition of a seasonal drilling restriction on activities in the Beaufort Sea. During 1986 the energy industry demonstrated its ability to conduct exploratory drilling above the objective horizon and downhole testing during the migration of bowheads and other whales. Although the findings of the study conducted during this drilling have not yet been released, it appears that the effect on the migrating whales has been minimal, if detectable at all. This research, when published, should dispute the theory that drilling and testing activity alone cause alterations in migration routes or other harm to the whales. This new knowledge, plus industry advances in drilling technology, oil spill prevention and oil spill clean-up, make the seasonal drilling restriction an overly stringent mitigation measure for an event of undemonstrated significance and with a very small likelihood of actually occurring. We recommend that this lease stipulation be excluded by the Secretary as unduly burdensome in light of the questionable benefits. 14-2

If a seasonal drilling stipulation is retained, Exxon would recommend altering the restriction to comply with the special research exception granted in 1986. Although this alternative is somewhat cumbersome, it would allow industry greater flexibility in conducting drilling operations while additional data is gathered concerning the impact of drilling on the migratory habits of the Bowhead whales.

Stipulation No. 5 - Transportation of Hydrocarbons (Page II19)

Exxon opposes this stipulation due to its restrictive effect on the way in which a lessee may transport its production. The decision on the final means of transportation of produced oil and gas is an issue that should await a point in time when reserve location and size, as well as current technology, may be assessed. As both pipeline and tanker transportation are environmentally sound alternatives, it is premature to mandate this decision at the DEIS stage of the leasing process. As drafted, the stipulation would force the lessee to utilize a pipeline system unless the lessor determined that pipelines would cause a "net social loss." This predetermination is not justified, and could cause marginal reserves to remain untapped. 14-3

Beyond mandating a pipeline system, this stipulation would also specify the routing of the pipeline system. Existing procedures and safeguards make this potentially costly and lengthy process unnecessary.

Alternatives IV, V, and VI

We believe that the potential reserves underlying the contemplated deferral areas of Barrow, Kaktovik, and Chukchi, when balanced against the speculative potential for localized adverse impact, argues for maintaining the full leasing alternative. The DEIS correctly notes that any adverse effects which might possibly occur from the inclusions of 14-4

these regions would in the vast majority of cases be minor. We believe that it would be inappropriate to exclude these prospective areas based on the slim possibility that their inclusion might have a negligible impact on the environment; therefore, we strongly recommend that these areas be included within the sale area.

We hope that you will find these comments constructive and that they will be of use to you in preparing the Final Environmental Impact Statement for the upcoming lease offering.

Very truly yours,

MGJ:GRM:jn
GRM#6.1

Response 14-1

This concern is addressed in Response 10-8.

Response 14-2

This concern is addressed in Response 10-1.

Response 14-3

This concern is addressed in Response 10-30.

Response 14-4

This concern is addressed in Response 13-2.

15

Doyle L. Jones
Production Manager
Alaskan District
Production United States

Marathon Oil Company

P.O. Box 102380
Anchorage, Alaska 99510
Telephone 907/561-5311

January 2, 1987

Regional Director, Alaska OCS Region
Minerals Management Service
Attn: Dick Roberts
949 East 36th Avenue, Room 110
Anchorage, AK 99508-4302

RE: BEAUFORT SEA SALE 97 DRAFT ENVIRONMENTAL IMPACT STATEMENT

Dear Mr. Roberts:

Marathon Oil Company is pleased to have this opportunity to comment on the Beaufort Sea Sale 97 Draft Environmental Impact Statement (DEIS).

As a member of the Alaska Oil and Gas Association (AOGA), Marathon participated in the compilation of comments prepared and submitted to MMS by AOGA. Our comments and views directly reflect those of the trade association.

Marathon commends MMS for their continuing efforts to lay the groundwork for the development and utilization of the nation's natural resources. We strongly support Alternative I of the proposed sale: The leasing of 3,930 blocks in the Beaufort and Chukchi Seas. The recovery of oil and gas in the area is an asset to the state and the nation which should be pursued. Alternatives II-VI, cancelling or deferring the sale, or deferring acreage would, in our opinion, be a detriment to the nation's economic potential. Any delay of sale would not allow improvement in mitigation of environmental impact.

Stipulation No. 4, Seasonal Drilling Restrictions for Protection of Bowhead Whales from Potential Effects of Oil Spills, proposes that exploratory drilling and testing activity be prohibited during the spring bowhead whale migration period in the Spring Migration Area. In agreement with AOGA, we urge the MMS to eliminate this stipulation from the final EIS, as the restriction is unnecessary. 15-1

Past experience and research have indicated that Bowheads will not be adversely affected by an oil spill.

Again, Marathon appreciates this opportunity to provide comment. Should you have any questions, please contact us.

Sincerely,

Doyle L. Jones

Doyle L. Jones

DEB/mrh

Response 15-1

This concern is addressed in Response 10-1.

NATIONAL OCEAN INDUSTRIES ASSOCIATION

1050 Seventeenth Street, N.W., Suite 700 Washington, D.C. 2003[illegible]

Charles D. Matthews
President

(202) [illegible]5-5116

January 6, 1987

Regional Director
Alaska Region
Minerals Management Service
949 East 36th Avenue
Anchorage, Alaska 99058-4302

RE: Request for Comments on the Draft Environmental Impact Statement for the Proposed Outer Continental Shelf (OCS) Lease Sale 97 (Beaufort Sea). (51 FR 40521, November 7, 1986).

Dear Sir:

In cooperation with the Alaska Support Industry Alliance, the National Ocean Industries Association participated in the December 17, 1986 public hearing in Anchorage relative to the proposed Beaufort Sea lease sale. As we testified, we strongly urge the Minerals Management Service to proceed with the sale as proposed in Alternative I of the DEIS. Our comments are reiterated here for your information.

NOIA is a trade association based in Washington, D.C. and is composed of over 325 member companies. Each of these companies is engaged in one aspect or another of discovering and recovering our nation's offshore energy resources; from geophysical data collection, drilling exploratory wells, and finally, developing the oil and gas if it is found. Additionally, NOIA represents all the companies who provide various services and supplies to each phase of offshore development. Examples of these companies include, but are not limited to, those that manufacture and supply drill bits, blowout preventers, drill pipe, casing, wellheads, logging equipment, and companies involved in diving, catering, banking, marine and air transportation, marine engineering, and construction. NOIA member companies are headquartered in 34 states and in the District of Columbia and have plant locations in all 50 states.

- 2 -

The Alliance, based in Anchorage, represents over 250 firms and organizations which, directly or indirectly, provide equipment, supplies, and services to the companies comprising the State of Alaska's petroleum and mining industries.

We want to thank the Minerals Management Service (MMS) for the opportunity to express our views on OCS Lease Sale No. 97, now scheduled for January 1988. We strongly urge the MMS to proceed with the sale as proposed in Alternative I of the draft environmental impact statement (DEIS) which would result in the offering of 3,930 blocks in the Beaufort Sea. Leasing this area is critical to our nation's interests since the MMS has estimated that about a 6[illegible] percent chance exists to find recoverable petroleum resources with a mean estimate of 650 million barrels of recoverable oil.

Resource potential such as this can not be ignored. Leasing, exploration, and hopefully, production of our nation's energy reserves must proceed for today, we find ourselves in a precarious position. We presently have a surplus of low priced petroleum created in large measure by temporary predatory foreign overproduction. This, unfortunately, is leading to a public misunderstanding and complacency regarding our nation's future energy needs and our national security. The dark side of temporary low prices and a world supply surplus includes:

(1) significant economic disincentives to invest in domestic petroleum exploration and development,

(2) reversal of our unprecedented energy conservation measures implemented over the last ten years,

(3) decreases in alternative energy technology development and application,

(4) increasing near-term demand and further dependency on foreign oil, and, most importantly,

(5) a serious and potentially fatal weakening of the American energy community including the support, service and supply industries.

Based on current consumption rates and domestic oil production decline, our dependency on foreign oil will rise from a current 40 percent to approximately 50 percent or more by the early 1990's. Inevitably, we will again suffer the economic vertigo of soaring oil prices, business failures, unemployment, and increased trade deficits. Therefore, it is more important than ever that our nation pursue a viable leasing program which will enable us to develop our domestic petroleum reserves. With world oil prices at their lowest levels in a decade, oil companies, as a result of depressed earnings, have significantly reduced their capital and exploration expenditures. With less money for exploration, we must be able to focus on the most promising offshore prospects which includes the area of the Beaufort Sea being offered in Sale No. 97.

Viable leasing opportunities are not only important to the nation, but to the nation's oil industry. Too many people do not seem to realize or care about the crippling effect this price drop has had on the state of the domestic oil service, support, and supply industries and their ability to remain viable today and in the future. This is especially critical because this exploration, development, and production infrastructure is the heart and muscle required to respond when a sudden shortage occurs because of a disruption in supply in the world, as it surely will in the not too distant future.

Major oil companies are most often identified in the public mind with oil and gas development, but, in reality, most of the actual work involved in looking for and developing oil and gas is perfomed by the service, support and supply companies. These companies collect the geophysical data, drill the wells and design, construct and install the platforms. They possess the equipment, the technical know-how, and the people to perform this work and must develop new technologies through ongoing research and development efforts and supply the investment dollars for the future.

Exploration, and hopefully production, of the most promising acreage is vital to domestic security. When we are denied access to potential reserves, we, as a nation, run the risk of increasing our already high reliance on imports from politically unstable areas of the world; and, at the same time, deny work to oil service, support, and supply companies who must remain viable for our nation to explore and develop its own oil and gas. We are not here to ask for sympathy for an industry in distress, but we are here to point out its effect on our nation and its security. Without a strong domestic oil industry, we put our nation's well-being at risk. As imports reach dangerous levels or when a sudden shortage occurs, the American public will demand a quick response by the oil industry. Given the current path we are on, we will not be able to respond because

this is not a case of opening a spigot or turning on an assembly line, but the response will take years to implement. We hope this country will not experience a sudden oil shock; but to protect us, we must pursue all petroleum reserves with significant potential, such as the Beaufort Sea. It will not solve all of our reserve problems, or all of the problems of the service, support, and supply companies, but it will certainly have a positive impact on both, which is so desperately needed.

The history of petroleum operations in the United States clearly demonstrates that the national objectives of oil and natural gas development and protection of the environment are compatible, both onshore and offshore. Today, offshore oil and gas exploration operations are conducted in waters of more than 64 countries. Many of these regions are also major commercial fishing areas, such as the North Sea, Cook Inlet, the Gulf of Mexico, the Bass Strait (Australia) and the Java Sea. More than 32,000 wells have been drilled in state and federal waters off U.S. coasts. And there has only been one spill where significant amounts of oil reached shore. Every day, in fact, some 1.2 million barrels of oil and 13.7 billion cubic feet of natural gas are being produced from offshore wells in an environmentally safe manner. Only a tiny fraction of the oil in the world's oceans -- about 5/100th of 1 percent of the total -- is attributed by the Minerals Management Service to offshore operations under federal supervision, including drilling, production, pipelines, and transportation to shore.

This record of environmentally clean and compatible operations prompts us to question the proposed lease stipulation which would impose a seasonal drilling restriction to "protect endangered bowhead whales from the risk of oil spills during their spring and fall migrations." This sitpulation would prohibit exploratory drilling, testing, and other downhole exploratory activities. We question the rational for such a restrictive and costly stipulation when it is important to note our irdustries environmentally safe operating record on the OCS.

In conclusion, we urge the MMS to proceed with this lease sale for the protection and prosperity of our nation. Thank you for this opportunity to express our views.

Sincerely yours,

Charles D. Matthews

Charles D. Matthews

CDM/tlm

Shell Western E&P Inc.
A Subsidiary of Shell Oil Company

Thomas ~~F~~ Hart
President

P.O.Box 576
Houston,Texas 77001

January 6, 1987

Regional Director, Alaska ~~OCS~~ Region
Mineral Management Service
Attention: Dick Roberts
949 East 36th Avenue, Room 110
Anchorage, Alaska 99508-4302

Gentlemen:

SUBJECT: BEAUFORT SEA SALE 97 DEIS

Shell Western E&P Inc., a subsidiary of Shell Oil Company, welcomes this opportunity to comment on the draft environmental impact statement (DEIS) for the proposed Beaufort Sea Sale 97.

In general, Shell Western agrees with the conclusions the Minerals Management Service describes in the DEIS. We believe MMS objectively evaluated the potential effects of industry operations on the living resources in the sale area. For the most part, the effects are summarized as minor or negligible, with only a few effects considered to be moderate. In particular, we support Alternative I, which provides for leasing 21.2 million acres in January 1988. Additionally, we fully support the specific comments on the DEIS submitted by the Alaska Oil and Gas Association, of which we are a member.

There is one area, however, about which we continue to have concerns. The DEIS states that Stipulation No. 4, the seasonal drilling restriction for protection of bowhead whales from potential effects of oil spills, will be applied to the Sale 97 area. We believe that the DEIS overstates the effect of oil on bowhead whales, and we suggest that the documents, authored by Dr. Joseph Geraci, which accompanied the comments submitted by the Alaska Oil and Gas Association, be carefully examined and considered in the preparation of the final environmental impact statement. 17-1

On a related matter, in Appendix J, page J-11, there is a statement that the National Marine Fisheries Services will prepare and include a current biological opinion on bowhead whales in the final EIS. We urge the MMS to allow industry to respond to this biological opinion before it appears in the final environmental impact statement. 17-2

Further to the discussion of the bowhead whale, we wish to point to the success of coincidental subsistence whale hunting and oil and gas exploration activities in the Beaufort Sea in 1986. In September and October of 1986, both marine seismic and exploratory drilling activities took place in the whale hunting areas of the eastern portion of the

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proposed lease sale area. While these activities were ongoing, the hunters of Kaktovik and Nuiqsut took and recovered four bowhead whales, 80 percent of their quota. We believe these results support the contention that exploratory activities are unlikely to affect the subsistence hunting of bowhead whales.

The success of this area sharing was due to the formation of an Oil/Whalers Group, which was established, independent of any governmental involvement, by the oil and gas operators and the Inupiat whalers. This group was instrumental in developing a field communications and coordination program designed to avoid conflicts in the mutual use of the Beaufort Sea. The program also provided emergency assistance to the whalers, and on two occasions aided in life-threatening situations.

We appreciate this opportunity to comment.

Sincerely,

Thomas F. Hart

Thomas F. Hart

MBD:DK

<u>Response 17-1</u>

This concern is addressed in Response 10-1.

<u>Response 17-2</u>

This concern is addressed in Response 7-13.

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REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

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STANDARD
ALASKA PRODUCTION

January 06, 1987
6715U

Mr. Alan Powers
Alaska OCS Office
Minerals Management Service
P O Box 101159
Anchorage, AK 99510-1159

Dear Mr. Powers:

Standard Alaska Production Company (SAPC) has reviewed selected parts of the Draft Environmental Impact Statement (DEIS) for Lease Sale 97, and we offer the following comments.

We believe that the MMS staff has done a very good job in preparing this document. The review of literature appears to be thorough and appropriately cited in the text.

Our major concern with the DEIS is the proposed Stipulation No. 4 which needs to be modified to take account of the progress that was made in 1986 with respect to removing seasonal drilling restrictions. Prior to 1986, the industry was prevented from drilling offshore during the period when bowhead whales were present. The rationale for this was largely that not enough was known about the response of the bowhead to exploration activities. However, it was impossible to learn anything more unless drilling was permitted while bowheads were present. Finally, in 1986, permission was granted to allow exploration drilling in waters where bowheads might be expected with an approved monitoring program in place. Several seasons will be required before sufficient data will have been gathered to fully evaluate the response of the bowheads to drilling, and therefore, there should be provision for drilling during the entire period when bowheads may be present, as long as an approved monitoring program is in place. 18-1

This past season also saw the formation of the Oil Industry/Whalers Working Group, which provided the vehicle for the development of mutual understanding and communication. Communication during the whaling season was accomplished by means of a sophisticated network that allowed for radio contact between industry vessels and whaling crews. This served to avoid potential interference with whaling by industry vessels and to provide for emergency assistance to the whalers.

A unit of the original Standard Oil Company
Founded in Cleveland, Ohio, in 1870

Mr. Alan Powers
January 06, 1987
page 2

SAPC recommends, then, that Stipulation No. 4 be modified to permit drilling within whale migration areas year-round with an approved monitoring program in place.

Attached are specific comments on selected parts of the DEIS dealing with bowhead whales and caribou.

We appreciate your attention to our comments. Please feel free to contact me at (907) 564-4037 if SAPC can provide any further information.

Yours very truly,

Steve D. Taylor, Manager
Environmental and Regulatory Affairs

SDT:MAF:dld

OCS 97 DEIS

SPECIFIC COMMENTS

III-31, ¶ 4:
Certainly one consequence of migration of caribou is that grazing is spread over a broad area. However, no mainland caribou population has ever overgrazed its range. Stocking densities are roughly 2-3 animals/sq.mi. on North Alaska ranges, but calculations suggest that Alaskan ranges could easily support more than 10 caribou/sq.mi. The evolutionary force that has caused the large migrations to take place is apparently related to predation, particularly by wolves, and thus the caribou are moving to areas of low wolf populations for calving. 18-2

IV-B-54, ¶ 4:
None of the described impacts, even in combination, are likely to lead to detectable effects on the bowhead population. Therefore, the conclusion should be that the effects would be NEGLIGIBLE rather than MINOR. 18-3

IV-B-56, ¶ 3:
The described impacts lead to a conclusion of NEGLIGIBLE cumulative impact on the bowhead population. 18-4

IV-B-60, ¶ 6:
The described impacts, particularly recognizing the growth of the gray whale population over the past two decades, even with expanded marine industrial and military activities throughout its range, leads to a conclusion of NEGLIGIBLE impact. 18-5

IV-B-62, ¶ 2:
For the reasons outlined above, the cumulative impact on the gray whale population would be NEGLIGIBLE. 18-6

IV-B-64, ¶ 3:
The Central Arctic Herd has been growing at a steady and rapid rate from the early 1970's, when it numbered approximately 3000 to the present (1986), when it was estimated to number at least 16,000. Clearly, the effects of any displacement have been NEGLIGIBLE, since there has been no detectable effect on the population. 18-7

IV-B-65, ¶ 3:
The petroleum industry has applied certain standards of pipeline and road design that permit caribou to pass freely. During periods of particular sensitivity it is possible to regulate vehicle traffic to avoid interfering with caribou movements. Given the current experience with the Central Arctic Herd, the impact of the described scenario would be NEGLIGIBLE. 18-8

IV-B-64, ¶ 4:
It is not likely that the impacts to caribou would exceed NEGLIGIBLE. 18-9

IV-B-66, ¶ 2 and 3:
The predicted level of impact for oil transportation west of Point Barrow is not stated, but it would be NEGLIGIBLE. 18-10

Response 18-1

This concern is addressed in Response 10-1.

Response 18-2

There is no conclusive evidence that any mainland caribou herd (population) has overgrazed its range. However, in this century (when biological information on the herds has been acquired) no mainland caribou herd in North America has been given the chance to reach the carrying capacity of its range prior to overharvest by man. Thus, overgrazing of habitat by caribou was never apparent. All documented caribou-population declines were primarily attributed to overharvest by man or overharvest in addition to high predation rates (Bergerud, 1974). On the other hand, predation alone has never been shown to be the cause of a caribou-population decline. Island populations of reindeer-caribou have experienced documented population crashes due to overgrazing of their range. In such situations, migration was nonexistent or movements were greatly restricted because the ocean or sea acted as a barrier to movement. Although the island reindeer-caribou herds that crashed were not subject to predation or harvest, severe winter weather with heavy snowfall limited the availability of forage and contributed to these population crashes. Island reindeer-caribou herds have limited or no opportunity to move from unfavorable to favorable habitat areas while mainland caribou herds have this opportunity. Documented shifts and expansions in mainland caribou ranges have occurred, and there is no evidence to link these movements with increased predation.

Predation on caribou particularly by wolves probably did play a part in the evolutionary strategy of parturient caribou cows that migrated north to open areas during the spring to give birth to their calves. The cows migrated in order to avoid easy predation on their young by wolves, which remain on the caribou herd's winter range during the spring when wolves are having their pups. However, predation avoidance does not explain why caribou cows concentrate their calving on particular parts of their calving range and that the locations of these concentrations vary from year to year. The availability of forage in the spring is believed to be the primary reason such areas are used by caribou.

The reasons for caribou migrations and movements are many: availability of spring forage plants and predation avoidance probably are reasons for the spring migration to the calving grounds, summer movements are attributed primarily to insect harassment, and fall migration probably is attributed to changes in weather conditions (snow and decreased temperature) and changes in the availability and quality of forage plants. Whatever the reasons that cause caribou to move and migrate from one range-habitat area to another, these movements prevent overgrazing of the habitat. Although the overall densities of Alaskan caribou on their combined summer and winter ranges are low (3 to 4 animals/mi^2) in comparison to the theoretical carrying-capacity estimate of 10 caribou per square mile, seasonal caribou densities on the calving ranges of the Western Arctic herd (39 animals/mi^2) and the Porcupine caribou herd (over 50 animals/mi^2) far exceed this value. Thus, caribou densities on the calving ranges are high enough that overgrazing could occur if the caribou-herd movements were greatly restricted on these ranges.

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Response 18-3

In accordance with our definition in Table S-2, any effect on a group of individuals would be considered a MINOR effect, whether or not that effect could be measured on the regional population. For example, an oil spill that resulted in the death or injury of a low number of whales would be categorized as having a MINOR effect because the low number of mortalities would not likely be detectable as a change in the species population. The effects most likely to be detected as a result of this sale would be changes in migration paths or avoidance responses whales would display to avoid approaching vessels and drilling operations.

Response 18-4

The MMS believes that cumulative effects on the species could be detectable and would occur at the MODERATE level.

Response 18-5

See Response 18-3, which addresses a similar concern regarding the bowhead whale. We believe MINOR detectable effects could occur to gray whales.

Response 18-6

The MMS believes that cumulative effects on the species could be detectable and would occur at the MODERATE level.

Response 18-7

Short-term changes in the distribution and movement of some caribou of the Central Arctic herd in response to pipeline and road construction in association with Sale 97 development would be defined as a MINOR effect--see the definitions in Table S-2. A MINOR effect does not represent a change in the overall distribution and abundance of the herd.

Response 18-8

Although it is possible to restrict vehicle traffic to avoid interference with caribou movements, the 97 EIS cannot assume such restrictions will be in place and enforced--MMS has no authority to regulate vehicle traffic on the North Slope. Problems with traffic temporarily interfering with caribou movements in the Prudhoe Bay area can and do occur.

Response 18-9

Habitat-alteration effects associated with the proposal are probably NEGLIGIBLE to the caribou herds. However, disturbance effects, especially the effects of motor-vehicle traffic adjacent to onshore pipelines associated with the proposal, are considered MINOR effects. The sources of habitat alterations are described in Section IV.B.6.a(2).

Response 18-10

The level of effect of transporting oil west of Point Barrow on the Western Arctic caribou herd (WAH) has been added to the text in Section IV.B.6.a(3)(c). The temporary disturbance and interference of movements of some caribou groups of the WAH is predicted to be a MINOR effect, not a NEGLIGIBLE effect. See Table S-2, Definitions Assumed in Effects Assessment.

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J N Eke
Division Vice President

Texaco USA
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Division

[illegible] Wilshire Boulevard
Los Angeles CA 90010
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December 31, 1986

COMMENTS ON DEIS FOR BEAUFORT
SEA OIL AND GAS LEASE SALE 97
(January 1988)

Mr. Alan D. Powers
Regional Manager
Minerals Management Service
P. O. Box 1159
Anchorage, AK 99510

Dear Mr. Powers:

Texaco is pleased to have this opportunity to comment on the DEIS for sale 97. With some reservations, we generally consider this document to be a very thorough and objective impact statement. In particular, we wish to register strong support for the proposed Alternative I, leaving intact the entire lease offering of 3930 tracts. We believe that Alternative II through VI tend to defeat the purpose of the OCS sale program, which is to make prospective offshore acreage available for expeditious exploration and production in the national interest.

Alternative II (No Sale) would not only cancel the possibility of discovering new hydrocarbon reserves, but would remove the chances of expanding prospects already being explored as result of previous Beaufort Sea Sales.

Alternative III (9-Year Sale Delay) is unacceptable. It makes no sense to delay this sale, which has been rescheduled twice before with no discernible benefit to anyone. It would in fact be competitively damaging to operators who have drilled confidential wells if the information on those wells were released to the public during a delay of sale 97.

Alternatives IV, V and VI (Deferrals of acreage at Barrow, Kaktovik and Chukchi) should not be seriously considered. The Chukchi deferral was removed from sale 87, and the sale 97 DEIS does not provide support for a repeat of that deferral. The environmental impact of the Chukchi deferral is predicted to be at the same level as that of the proposed Alternative I, therefore, the deletion of this area would not lessen the impact of the proposed sale. Industry has invested very substantial

outlays for exploration in the Chukchi area during the past several years, and the region is known to contain prospective rocks and structures.

We would also take issue with the calculation in the DEIS that the Chukchi deferral, containing about 42% of the total sale 97 area, contains only 4.6% of the resource estimate of the entire area. We believe the area to be substantially more prospective than that. 19-1

We support the inclusion of the Barrow and Kaktovik deferral areas in the sale for reasons similar to those above; i.e., these are prospective areas, on trend with established production, and industry has committed very substantial expenses to exploration. The discussions of the Barrow and Kaktovik deferrals in the DEIS conclude that predicted environmental effects are essentially unchanged from the full sale proposal.

In summary, we are convinced that the preferred alternative of offering the entire sale 97 area for lease is right on target. We would point out that any delay or reduction of the sale is contrary to the national interest, in that it could lead to our increased vulnerability to foreign oil supply interruptions. Industry operations in adjacent sale areas have proved our ability to work safely in the Beaufort Sea, and we believe sale 97 should be held on schedule if national energy needs are to be met.

We appreciate this opportunity to comment. Please contact us if you should have any questions.

Very truly yours,

J. N. Eke

DCH:dl
D22/300

Response 19-1

The discussion of the potential oil resources of the deferral alternatives recognizes that the quantities mentioned are only estimates. Thus, the deferral-alternative areas may contain less or more oil than is estimated. Furthermore, because the production scenario for Sale 97 assumes that a production platform will be located in the Chukchi Sea part of the sale area, there is the tacit implication that the deferral area may contain commercially recoverable oil resources.

The resource estimate stated in the Sale 97 FEIS is for the Alternative VI area; this alternative area is formed by deleting the blocks of the Chukchi Deferral Area from the Sale 97 proposed area. The potential resources of the Chukchi Deferral Area are not stated in the FEIS because they are statistically derived estimates: the resources of the various areas should not be arithmetically added or subtracted.

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UNOCAL 76

Robert T. Anderson
District Land Manager
Alaska District

January 6, 1987

U. S. Department of the Interior
Minerals Management Service
Alaska OCS Region
949 E. 36th Avenue, Room 110
Anchorage, AK 99508-4302

Attention: Regional Director

STATE OF ALASKA
ENVIRONMENTAL IMPACT STATEMENT
Beaufort Sea OCS Sale #97

Gentlemen:

Union Oil Company of California appreciates the opportunity to submit comments on the draft Environmental Impact Statement on OCS Sale #97/Beaufort Sea. Our comments are as follows:

A. Sale Alternatives

We feel that Alternatives I, IV and VI are all acceptable because they will allow continued exploration of the most prospective portions of the Beaufort Sea Planning Area.

Alternatives II, III and V should be rejected because they would seriously hamper continued exploration in this most prospective area.

B. Stipulation Number 4

Union strongly objects to this stipulation which restricts exploratory drilling, testing and other downhole exploratory activities during the bowhead whale migration periods. The Draft EIS totally disregards the compatible, safe and nondisruptive exploratory drilling activities by Unocal and SWEPI during 1985 and 1986 drilling season in the Camden Bay area. The information indicating the lack of impact from those operations should be included in the Final EIS. **20-1**

C. Information to Lessees Number 5

We feel that the Final EIS should incorporate information concerning the successful, voluntary cooperation between Industry and the whaling captains during the summer of 1986 to minimize potential conflicts during the Fall whale migration. **20-2**

Information to Lessees Number 7

Unocal feels that this stipulation concerning possible noise disturbances of bowhead whales is unnecessary. The Final EIS should incorporate the results of last summer's whale monitoring program which assessed the affects of noise from the drilling operations in Camden Bay on the migrating bowhead whales. **20-3**

Again we thank you for the opportunity to comment on this Environmental Impart Statement.

Very truly yours,

Robert T. Anderson

Response 20-1

This concern is addressed further in Response 10-1.

Response 20-2

The text in Section IV.B.9.a(2)(a) has been revised to address the concern.

Response 20-3

This mitigating measure has been proposed as an Information to Lessees and as such is advisory in nature. The Regional Supervisor, Field Operations, has the authority to suspend operations on lessees, regardless of whether or not this is explicitly stated in this mitigating measure. The value of this mitigating measure is that all parties will know in advance that the MMS intends to take action to prevent jeopardy to bowhead whales from noise-producing operations and that this action could include the temporary cessation of operations when bowhead whales are in the near vicinity.

The concern regarding use of information from the whale monitoring program is addressed in Response 10-1.

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GREENPEACE U.S.A.

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Anchorage, Alaska 99510

Tel. (907) 277-8234

January 6, 1986

Mr. Al Powers
Regional Director, Alaska OCS Region
Minerals Management Service
Attn: Dick Roberts
949 E. 36th Ave., Room 110
Anchorage, AK 99508-4302

Dear Mr. Powers:

The following comments on the Draft Environmental Impact Statement for the proposed Beaufort Sea Outer Continental Shelf Oil and Gas Lease Sale #97 are submitted by Greenpeace on behalf of the undersigned organizations. Greenpeace is an international environmental organization with offices in 15 countries. Our membership of over 600,000 in the United States includes 1,600 Alaskans.

Having thoroughly reviewed the DEIS, we are opposed to this lease sale in its entirety. Overall, we must conclude that the risks posed by developing these potential oil and gas reserves do not warrant risking the unique biological resources which are dependent on habitat within the proposed sale area. We found that important issues concerning how this proposed sale would impact the Beaufort Sea and the resources which depend on it were omitted, inadequately discussed, or grossly discounted. Furthermore, it was not demonstrated that technologies are available to develop the potential oil and gas reserves safely.

Should the Department of the Interior insist on going forward with this sale, we request that at the very least the Chukchi Sea, Pt. Barrow, and Kaktovik Deferral Areas be removed from the lease offering in order to minimize negative impacts. In the case of a sale, we would also request that stronger stipulations than those discussed in the DEIS be imposed. At the very least, Sale #97 stipulations should require the same level of protection as those listed in the Sale #87 Notice of Sale.

POTENTIAL RESERVES AND RISKS

As stated above, we do not feel that the potential oil and gas reserves estimated for the proposed sale are worth the potential risks. The DEIS finds that there would be a 65% chance of producing 650 million barrels of oil. With national consumption at 16 million barrels per day, that would be the equivalent of 40.6 days of oil. 21-1 Production of natural gas reserves is not believed to be economically feasible. According to the DEIS, the 21-2

risk of developing this small, potential reserve would include a 65% chance that the area would be exposed to 1 or more spills over 100,000 barrels each of which would oil at least 90 km of shoreline. In addition, there would be over 99% chance of 1 or more spills over 1,000 barrels. The DEIS estimates 24.4 of these spills with each spill averaging 7,700 barrels per spill.

Oil spills in the arctic environment can be expected to have longer lasting impacts than spills in more temperate climates. The DEIS (IV-A- 12) finds that stranded oil which reaches a shoreline could persist for decades. Toxicity is also resilient due to slow decomposition and weathering. Prudhoe Bay crude was toxic to zooplankton 7 years after an experimental spill (IV-B-117). 21-3

The risk of jeopardizing whale populations through contamination, disturbance, and development in or near the open lead system carries with it the risk of destroying the subsistence livelihoods of local Inupiat. Their great understanding of man's relationship with nature is an invaluable asset to global ecological survival that must not be risked in the quest for potential short term benefits of oil and gas development. 21-4

Even assuming that there was a 100% chance of developing in full the potential reserves, in view of the grave risks to the inherent worth of the ecosystem as well as to the livelihoods of local residents who depend on the biological resources of the Beaufort Sea, this lease sale is not warranted.

DEFERRALS

In case The Department of the Interior does decide to hold this lease sale, we recommend that at a minimum, the areas covered in all three deferral areas be removed from the sale.

Pt. Barrow

There is no question that the waters surrounding Pt. Barrow, especially this area's spring lead system, are of critical importance to an extensive range of resident and migratory species. The Department of the Interior fortunately recognized this by deleting this area from Sale #87. The same values and risks to this area hold true today and again this area must be removed from the lease sale.

Evidence of the importance of this area and the high degree of risk involved are found throughout the DEIS and are also well documented in the literature. Without question, this area is recognized as a concentration area for both the endangered bowhead whale and the beluga whale. The area at highest risk of being contacted by an oilspill from activities associated with the proposal is this spring lead system. The probabilities of contact with an oil spill are 26-96% along the spring migration corridor. The spring lead system is a highly restricted and 21-5 limited habitat. If an oilspill or noise and disturbances would 21-6 affect whales in the lead system, there are no alternative routes by which whales could escape the associated impacts.

Areas contained within the Pt. Barrow Deferral Area also include the Plover Islands which are felt to be an important feeding area for birds. Figure IV-16 also identifies the area as an important gray whale area. 21-7

Given the extremely high value of the area, the high risk of impacting this area posed by the proposal, and the small potential oil and gas resources contained within the area (only 30 million barrels), we recommend that the Pt. Barrow Deferral area be removed from the proposed lease sale. 21-8

Kaktovik

Although this is not emphasized in the DEIS, the waters contained in the Kaktovik Deferral Area are also recognized as serving high concentrations of feeding and migrating endangered bowhead whales. It would be inexcusable to expose a significant portion of the entire bowhead whale population and critical bowhead feeding habitat to the unknown potential impacts of oil spills noise, and disturbance associated with developing this area. 21-9

Again, the Department of the Interior is faced with risking resources of known biological value for unknown oil and gas reserves which are predicted to be quite small, only 90 million barrels. We recommend that the Kaktovik Deferral Area be removed from the proposed lease sale. 21-10

Chukchi Sea

Virtually no information which is directly derived from studies in the Chukchi Sea Deferral Area is presented for discussion. Almost all of the brief discussion concerning this area is done by extrapolating information from areas in the Beaufort Sea which may or may not actually be similar environments. The information specific to this area is extremely limited and vague. For example, page III-28 states that bowhead fall migration may enter this area. Given that the bowhead whale and other undiscussed resources may be at risks which are not currently evaluated in the DEIS and that the area is predicted to contain minimal resources, only 30 million barrels, the Department of the Interior should remove this area from the proposed lease sale. 21-11

STIPULATIONS AND INFORMATION TO LESSEES (ITL)

No explanation is offered for why stipulations as well as Information to Lessees which are designed to mitigate impacts to the same areas and resources affected by Sale #97 have been greatly relaxed from the measures included in the Sale #87 lease agreements. 21-12

Specifically, within Stipulation #4, Seasonal Drilling Restrictions for Protection of Bowhead Whales from Potential 21-13

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Effects of Oil Spills, there is no reason to reduce the time for drilling restrictions in western blocks from September 1 - October 31 to September 15 - October 31. At a minimum the requirement adopted for Sale #87 should be retained with the written understanding that this period of drilling restriction can be extended if bowhead whales are present in the area.

There is no justification for removing the requirements pertaining to emergency transport vessels in Stipulation #5, Transportation of Hydrocarbons. These requirements should be retained. 21-14

It is inexcusable that Stipulation #6 concerning oil spill cleanup capability has been removed. Designating responsibility for effective oil spill prevention and cleanup must be a top priority for any lease agreement. This Stipulation should be reinstated with the additional qualification that lessees be prepared to undergo periodic, unannounced oil spill drills to insure that personnel and equipment are capable of responding to oil spill emergencies. 21-15

Within ITL #1, Information on Bird and Marine Mammal Protection, no explanation is given for why the bowhead whale monitoring program required in Sale #87 is discontinued for the proposed sale. How will the Regional Supervisor, Field Officer gain the information necessary on bowhead activities to be able to advise lessees on how best to operate with least impacts to the bowhead 21-16
whale? Furthermore, there was no reason to remove from ITL #1 the notice that lessees may need to coordinate with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service under 16 U.S.C. 1371 (a)(5). This statute is still in effect. Both of these points should be reincorporated into ITL #1. 21-17

ITL #2 , Information on Areas of Special Biological and Cultural Sensitivity, previously noted that dispersant was not agreed on as a first line of defense in oil spill cleanup and that it may be especially inappropriate for use near the Boulder Patch or upcurrent of the Boulder Patch. The DEIS even states in IV-B that oil plus dispersant can be more lethal than oil alone. In light of the unchanged status of the problems associated with dispersants, this information should be reinstated. 21-18

The most unacceptable case of weakening the information presented is within ITL #7, Information on Endangered Whales. Previously, "taking" of whales through disruption associated with the lessees' activities was listed as criteria for suspending operations. This criteria has now been increased to "jeopardizing" whales. No new evidence is presented anywhere in the DEIS or to our knowledge has become available since Sale #87 which would warrant this change. This ITL should be retained at a minimum as written in the Sale #87 lease agreements. Preferably, suspending operations if bowhead whales are being "taken" should be formally incorporated into Stipulation #4 by clearly stating the conditions and procedures for suspending operations and requirements which must be met before operations can be resumed. 21-19

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In addition to weakening the listed ITL's, the DEIS fails to include 14 ITL's included in the last lease agreement. No explanation is given as to why these are no longer necessary. All the ITL's should be reinstated. Especially important are ITL's concerning bowhead whale studies, transportation, offshore pipelines, collecting information on ice hazards, and shallow hazards seismic activity. 21-20

DISCUSSION OF RESOURCES AND EFFECTS IN THE DEIS

In general, the lengthy DEIS is extremely disappointing in its description of affected resources and potential impacts to these resources posed by the proposed sale. Information describing resources is given in broad, generic terms. Baseline studies are significantly lacking for this area. Specific information on which species are present at specific locations at different times in the year is not given even when the data is available and best available data is not referenced. Information is rarely quantified to the greatest extent possible so that it is difficult to determine the magnitude of potential risk to different populations in different areas. 21-21

The potential impacts to resources are generally downplayed. For example page IV-A-6 notes that only migratory species are likely to be hit by more than one oil spill. Virtually all the species in question are migratory. 21-22

Finally, the DEIS fails to identify where comments are speculative and where they are backed by verifiable data. This is especially misleading in questions concerning potential 21-23
impacts. For example, the information concerning bowhead whale habituation to noise sources is purely speculative but this habituation is presumed factual when assessing overall impacts to bowhead whales. 21-24

Bowhead Whale

Biological Opinion

The most glaring omission in the DEIS is the lack of the Biological Opinion prepared by the National Marine Fisheries Service pursuant to Section 7 of the Endangered Species Act concerning the effects of OCS oil and gas leasing and exploration activities associated with the proposed sale.

The question of whether or not the proposed sale would jeopardize this endangered species is arguably the most important issue of public interest from both a biological and cultural standpoint which needs to be examined by the DEIS. The Department of the Interior's negligence in failing to present this opinion deprives the public of their right to evaluate and comment on this gravely important issue. 21-25

A Biological Opinion was previously developed and presented for

Sale #87 which involved the same area offered for lease in this proposed sale. That opinion found that the bowhead whale could be jeopardized by activities associated with Sale #87. Consultation for the Sale #97 Biological Opinion began most recently on July 17, 1985, although the Alaska Regional Office of the National Marine Fisheries Service submitted an opinion to the Washington, D.C. office of NOAA as early as two years ago. It is not satisfactory that the opinion "might" be available for the FEIS as stated in Appendix J as there is no reason why the public should be denied the opportunity to review this information within the DEIS.

We submit that the Department of the Interior must either extend the comment period until this Biological Opinion is included for public review or offer another comment period after the Biological opinion is made public to insure that public participation is not precluded in evaluating the proposed sale.

Impacts to the Bowhead Whale

Discussion of potential impacts to the bowhead whale within the DEIS is inconsistent, highly speculative, and tends to discount possible negative impacts.

Table II-C-1, Summary and Comparative Analysis of Potential Effects for Alternatives I, IV, V, and VI, gives contradictory information on overall impacts to the bowhead whale. The DEIS claims only MINOR impacts to the bowhead whale and does not discuss the possible implications of an oil spill contacting the whales especially within the restricted lead system. On the other hand, in the section concerning Subsistence Harvests, the possibility of contact with an oil spill is discussed and the potential effects are categorized as MAJOR. The reader who is most interested in the bowhead whale as a species but not as a subsistence resource may then be misled to think that potential contact with an an oilspill in the open lead system is not a concern and that only MINOR impacts can be expected from the proposed sale when in fact MAJOR impacts are a distinct possibility. Overall, the finding that the cumulative case might result in MODERATE effects on the bowhead whale is unacceptable for this severely endangered animal. 21-26

Information on bowhead whales' reactions to noise and disturbance is mostly conjecture. The DEIS , without backing from studies, finds that whales would probably avoid drillships by several kilometers and probably habituate to stationary, constant noise sources. Currently, two industry sponsored and one MMS sponsored study of the effects of noise on bowhead whales are unfinished and not available. No studies which support assumptions in the DEIS exist. On IV-B-55 the DEIS claims that bowheads may actively avoid oil contact. This claim is unsubstantiated. There is also no explanation of why Fall Feeding Area B referred to on IV-B-55 would probably not be contacted by oil. 21-27

Gray Whale

Information on the gray whale in the DEIS is extremely limited. Again, the DEIS lacks specificity with regards to habitat and comments need to be quantified. Page III-29 finds that the nearshore waters of the Chukchi Sea are important for feeding. This is an enormous area. Which area is most important? What depth is the limit of nearshore waters? Little data is available on the distribution of food organisms. The DEIS finds that it is "likely" that gray whales are feeding in affected waters. This basic information needs to be clarified in order to make sound decisions. 21-28

The gray whale is also not represented in the Graphics which are the most convenient source for evaluation. This is true of Graphic #2 which illustrates trophic relationships. What do gray whales in the proposed sale area eat? This information is required for determining whether these organisms or their habitat 21-29
are at risk. Gray whale concentration areas should be included on the prominent Graphic #4, Marine Mammal Habitats, and not buried in Figure IV-16. 21-30

Again, the cumulative impacts of all proposed development activities is listed as MODERATE. This is unacceptable in the case of an endangered species. To this end we have and will continue to insist on protection of the gray whale and its habitat throughout its waters including proposed OCS lease sale areas. 21-31

Beluga Whale

As with the bowhead whale, Table II-C-1 gives contradictory information concerning the beluga whale. Again, impacts are listed as MINOR and the possibility of contact with an oilspill in the open lead system is not discussed. Yet, impacts to subsistence harvests with the possibility of an oil spill in the lead system is found to be MAJOR. As with the bowhead whale, the DEIS misleads the reader. Section IV-B also contains no discussion of the possible impacts of beluga whale contact with an oil spill in the lead system but does tell us that thousands of whales use the system. This would indicate that a significant portion of the beluga whale population could be affected by such a spill. 21-32

Habitat used by beluga whales is not clearly identified. The DEIS refers to areas "such as" Peard Bay. This approach makes it impossible for the reader to assess which areas are of greatest importance and to what degree they are important. 21-33

Pinnipeds and Polar Bears

Considering the importance of the proposed sale area to large populations of ringed and bearded seals, walruses, and polar bears, the information presented can only be described as cursory. Basic questions which are not addressed include: What percentages of the entire populations of these species may be affected? Which numbers of these animals can be found at specific 21-34

locations within the proposed sale area? What concentrations of these species are present? Little information is given on the effects of contact with oil or noise disturbance specific to each species. Especially since seals, walrus, and polar bears are not likely to avoid oil (IV-B-35), greater attention should be given to the affects of oil contact with each species.

At a minimum, ringed and bearded seal habitat should be specifically indicated on Graphic #4. The active and floating fast ice zones incorporate the entire northern coastline. There needs to be some indication of which areas are of greatest importance. There is no indication of polar bear habitat beyond coastal concentration areas. What other areas are important? Overall, given the paucity and general nature of the information, it is difficult to make substantive comments on potential risks to these species posed by the proposed lease sale. 21-35

Birds

The discussion of birds and impacts on birds suffers from the same lack of specificity seen elsewhere in the DEIS. We are told that several million birds of approximately 150 species may be affected. This information needs to be presented on a species by species basis. Description of habitat is also unacceptably vague and again references habitat by type using the phrase "areas such as". Specific locations which are important to bird species need to be identified, the relative importance of these locations needs to be quantified, and the timing for when each location is important needs to be described. 21-36

Fish

The analysis of impacts to fish is lacking basic information. These deficiencies in turn lead to conclusions which underestimate overall impacts.

For example, Table IV-B-1, lists saltwater habitat for anadromous fish as being pelagic when in fact their habitat is only the relatively restricted nearshore coastal waters. These waters are generally less than 2 meters deep and any spill in this area would devastate local anadromous fish stocks. The fish are not found in the larger area implied by the category "pelagic" and would not be likely to avoid contamination within their range. 21-37

Contamination of nearshore waters would also affect all age classes not just juvenile fish (IV-B-17). Since all age classes are at risk and the DEIS only accounts for one year class in its risk assessment, the conclusion of overall effects on fish stocks is greatly underrated. 21-38

The discussion of which species are at risk is again unduly generic and emphasizes species which are of minimal importance. Studies do exist with specific information about fish stocks and the areas which they use. These include: a National Marine Fisheries Service study as part of the Endicott Monitoring Pro- 21-39 gram, Surveys of Domestic And Commercial Fisheries in the Eastern Beaufort Sea by Envirosphere, 1985, and two studies on the Colville River Delta by John George, 1986. For unexplained reasons, the DEIS devotes a large portion of discussion to salmon stocks which are of minor significance relative to arctic char, arctic cisco, broad whitefish, and least cisco which receive limited attention.

Lower Invertebrates

Food chains in the Beaufort Sea are very short and simple with few stages between primary producers and large vertebrates such as whales and other marine mammals. Timing of primary production is also very important since virtually all production must occur
during the brief summer season. These considerations are very 21-40
important when evaluating the proposed lease sale and greater significance should be given to evaluating impacts on pelagic, benthic, and epontic communities.

No discussion is included on the effects of large spills on invertebrate communities although the possibility of a large spill is predicted in the DEIS. This impact should be evaluated
with special attention to the impacts of large spills at critical 21-41
periods such as early spring when epontic organisms may be the only available food source. The effects on invertebrate communities of oil spilled during the winter escaping in a surge during the spring melt also need to be evaluated.

The probability that impacts on invertebrate communities will be long term needs to be emphasized in the overall assessment since invertebrates provide the basis for the entire ecosystem. Shifts
in benthic community composition are likely to be persistent 21-42
especially if sediments are contaminated (IV-B-6). Page IV-B-117 also states that toxicity for invertebrates is expected to be prolonged in Alaskan conditions.

DISCUSSION OF GEOPHYSICAL HAZARDS

The area proposed for sale includes extreme geophysical hazards which may limit the ability of lessees to operate safely. While hazards are generally described, quantified information is lacking.

The discussion of sea ice totally ignores the phenomenon of "ivu" which entails sudden, dramatic movement of enormous ridges of ice. This issue frequently has been pointed out to MMS by
knowledgeable elders and needs to be addressed in the DEIS. The 21-43
DEIS should discuss quantitatively the maximum ice forces present in the area and where they are located so that the reader can evaluate whether technology to handle these forces is available or is likely to be produced and which areas are of greatest hazard.

Similarly, the DEIS should include a map of fault zones. As
seismic activity information dates back only to 1968, the very 21-44
real possibility of an earthquake larger than those which have been monitored in the past eighteen years should be discussed.

DISCUSSION OF TECHNOLOGICAL CAPABILITIES

Conditions are common within the proposed sale area for which proven technologies for safe oil and gas development do not
exist. The idea that technologies exist to handle oil spills 21-45
within the proposed sale area is a myth.

Exploration and Production

In Appendix L, page 6, the DEIS states that less than 10% of the proposed sale area is shallower than 20 meters, less that 20% is 20-40 meters, and over 75% is over 40 meters. Artificial islands are only good in waters up to 20 meters deep and bottom founded mobile units are good in waters up to 30 meters deep so that other technologies would have to be used in the majority of the
area. Floating drillships, which have never been used in the 21-46
Alaskan OCS are rated for depths up to 300 meters. However, the proposed sale area includes depths up to 1,000 meters deep. No technologies capable of handling exploration in these deeper waters are even suggested. Technologies for production platforms in deeper waters, even those under 300 meters deep, are also not discussed.

Overall, the vast majority of the lease sale is proposed for areas where technologies have never before been tested in Alaskan waters or simply do not exist. By offering areas for which tech-
nologies do not exist, the MMS is increasing the risk of negative 21-47
impacts since areas will be subject to unproven technologies. This increases the risk of impact and should be discussed in the DEIS.

The discussion of subsea pipelines fails to discuss the un-
resolved problem of monitoring leaks under the ice. This 21-48
omission discounts the possible effects associated with pipelines.

The DEIS discounts impacts from the probable construction of causeways. Causeways are presented as being necessary only during production when actually they have been and will continue to be a necessary part of exploration activities. Since the nearshore
area is generally shallow, past experience as with the Mukluk 21-49
project, has shown that causeways extending up to 1 1/2 miles from the shore will be necessary to reach depths where barges can be loaded for transporting gravel to artificial island sites.

Oil Spill Cleanup

Oil spill cleanup should be included in Section II-A, Activities Associated with Exploration Development and Production, so that
it is duly recognized as an integral part of development activi- 21-50
ties. In general, its treatment in Section IV-A-2-c is too vague. Specific information needs to be presented on past and

proven applications of suggested technologies in conditions found in the proposed sale area in order for the reader to draw conclusions on the degree of risk posed by oilspills.

By overrating the ability of the available technologies to respond to oil spills in conditions found in the proposed sale area, the DEIS grossly discounts the possible problems posed by oil spills. The lack of technologies which are suitable for the Alaskan OCS in general is mentioned on page IV-A-15, "Out of necessity or otherwise, natural dispersion [in other words, not doing anything] has frequently been the chosen response (to oil spills) in Alaskan waters." 21-51

The evaluation of oil spill cleanup technologies presented in Figure IV-12 is not supported by proof that the listed techniques can be used reliably in Beaufort Sea conditions. Even accepting that this evaluation is not grossly overrated, conditions are still found for which no "good" technology is claimed. There are no good containment techniques in broken ice of 3-5 oktas and no good recovery techniques during freezeup. Perhaps the most grossly overrated technique is in situ burning for disposal which simply has not been demonstrated to be effective in broken ice conditions. 21-52

The discussion of oil spill cleanup capabilities discounts the fact that cleanup is possible only if equipment and personnel can be delivered. In order to present a fair presentation of the likelihood of effective oil spill cleanup, the DEIS should discuss the number and percentage of days each season when mobilization of clean up efforts might be impossible. 21-53

OIL SPILL ANALYSIS

As discussed above, the generic description of the affected biological resources makes it difficult for the reader to use the oil spill analysis to the extent desired since specific areas of critical habitat are not well defined. The analysis itself is also missing important components and is based on assumptions that downplay possible oil spill impacts. 21-54

The analysis includes discussion only of oil spills hitting U.S. waters or shoreline and fails to discuss possible impacts on the adjacent MacKenzie River Delta ecosystem. Impacts on this area are of great importance to many migratory species of note including the bowhead whale. By omitting this consideration, the DEIS fails to address one of the most potentially devastating impacts which could result from the sale. The analysis also fails to include the planned Chukchi Sea OCS Oil and Gas Sale #109 in the cumulative case. This omission is unwarranted since many of the same resources which stand to be impacted by this sale also frequent waters within the proposed Sale #109 area. 21-55

It is unclear whether the data base for oil spill analysis is based only on reported oil spills or takes into consideration unreported spills. The inclusion of unreported spills would 21-56

probably increase both the number and size of spills predicted so that the overall impacts expected would also be increased.

It is also unclear how the oil spill analysis compensates for the fact that, unlike most bodies of water, the Beaufort Sea only briefly has fully open seas. These conditions would tend to concentrate boat and tanker activities to confined open water portions of the area throughout much of the year. How does the oil spill analysis account for this concentration and how is the associated concentration of impacts to biological resources which use the open water areas assessed? 21-57

The oil spill analysis apparently does not include proposed nearshore state oil and gas lease sales in its evaluation. This omission is exceptionally unacceptable in the case of Demarcation Point Sale #55. Spills associated with this spill would directly affect bowhead whale habitat. The increased impacts associated with this state sale to the bowhead whale should be a critical consideration in evaluating the need for Sale #97, especially when evaluating the need for the Kaktovik Deferral area. 21-58

The oil spill analysis of impacts to subsistence resources fails to include the full area used in subsistence activities. The Subsistence Resource Areas used for the oil spill analysis shown in Figure IV-17 are only part of the coastal and offshore subsistence areas shown in Figure III-14. Why were these important areas excluded from the analysis? 21-59

In general, the oil spill analysis and the DEIS fail to address the issue that oil spilled during the winter will be trapped in the ice an released all at once during the spring melt. This concentrated contamination may be more destructive than indicated in the DEIS since it will be affecting spring primary production by epontic organisms which are thought to be the most important food source available at that time of year. The assumption on page IV-A-10 that spills which occur during the shorefast ice season are not relevant to the coast is unfounded since trapped oil may still be expected to reach the shoreline when the ice melts in the spring. 21-60

DISSCUSSION OF ONSHORE IMPACTS

The discussion of onshore impact neglects important issues and is frequently at odds with development assumptions made by other divisions within the Department of the Interior.

The analysis of the impacts of a potential pipeline across the National Petroleum Reserve Area (NPRA) fails to include a discussion of impacts to the Western Arctic caribou herd. 21-61

The DEIS presumes that pipelines across the NPRA are acceptable. However in The Teshekpuk Lake Special Study Area Habitat Evaluation report, the Bureau of Land Management concludes that due to a lack of available information on wildlife resources, especially migratory birds, no recommendation could be made as to 21-62 whether the area should be opened to impacts from oil and gas leasing.

The DEIS assumes that no onshore pipelines will occur on the Arctic National Wildlife Refuge while the Fish and Wildlife Service has just concluded a much awaited report to Congress which discusses pipelines and associated impacts in this area 21-63

DISSCUSSION OF AIR QUALITY

The DEIS virtually ignores the question of air quality. MMS should be aware that the State of Alaska has recognized that air quality will become an increasingly significant problem in the arctic with increasing industrialization. This was most recently noted in a memo from the Alaska Department of Environmental Conservation to the Alaska Department of Natural Resources concerning information requests for the proposed Camden Bay Oil and Gas Lease Sale. 21-64

DISSCUSSION OF ENERGY CONSERVATION

The discussion of energy conservation as a viable alternative to the proposed sale is deficient and unacceptably out of date. The most recent information cited in Appendix A is form 1979. Notable advance in the field of energy conservation have been mad in the past seven years and these would greatly. If actively applied, this increase in national energy efficiency would easily compensate for the potential oil and gas reserves discussed in the proposed sale area. 21-65

SUBSISTENCE AND SECTION 810 ANALYSIS

<u>Discussion of Subsistence</u>

In a rare instance of realistic assessment, the DEIS finds that an oil spill associated with the proposed lease could have a MAJOR impact on subsistence whaling (IV-B-89)

Elsewhere however, the DEIS discounts possible impacts to subsistence. The DEIS finds impacts to biological resources to be significant only if regional populations are affected. Yet, for the purposes of subsistence, impacts to local populations are of utmost importance. If a species is unavailable locally, then it is of little consolation that the regional population remains viable. 21-66

This attitude is especially true with the discussion of subsistence fisheries. For example, fish resources are classified as being the same for Wainwright and Kaktovik. These villages are located on two different seas and use totally different fish resources. This same casual attitude is seen in grouping subsistence the village of Atquasuk with Barrow. Atquasuk is inland while Barrow is coastal and their uses and dependence on subsistence resources vary accordingly. 21-67

<u>Section 810 Analysis</u>

The proposed sale is likely to cause impacts that would significantly restrict subsistence harvests by reduction of subsistence species' populations and by restricting access to subsistence activities. Under these circumstances, the Department of the Interior must determine whether the proposed sale is necessary, whether the minimal possible amount of public land is used to achieve the goal of the proposed sale, and whether efforts have been outlined within the proposal to mitigate impacts to subsistence resources and activities. This analysis is required by Section 810 of the Alaskan National Interests Lands Act and has been upheld by recent court decisions.

While the Department of the Interior begrudgingly includes this analysis, the conclusion that all three criteria required under Section 810 have been met by the proposed sale is untrue.

This proposed sale is unnecessary in terms of meeting national energy needs since it involves the uncertain recovery of oil and gas reserves which are estimated to be quite small in terms of national consumption. Yet, activities associated with the proposed sale would put at extreme risk unique biological resources which serve as the basis for Inupiat subsistence. 21-68

The DEIS claims that the minimal amount of public land is used since only a small area will ever be developed. This conclusion fails on two points.

First, even if developing the estimated oil and gas reserves were necessary, this goal could be achieved by offering a much smaller area for lease. This is seen clearly when reviewing the proposed deferral areas. These areas, which are recommended for deferral for their special importance to biological resources, are estimated to contain only small fractions of the reserves estimated for the entire sale area. If the Department of the Interior were sincere in its compliance with Section 810, these areas would be removed from the proposed sale. 21-69

Secondly, an area does not need to fully developed to be impacted. Exploration activities also cause a wide range of impacts so that potentially the entire lease area may be subject to impact.

The requirement to mitigate impacts to subsistence is blatantly ignored. This is seen both in the insistence on offering areas for sale which are of documented, critical importance to subsistence activities and resources and by relaxing proposed stipulations in the lease agreement as discussed earlier in these comments. 21-70

CONCLUSION

In summary, we are opposed to oil and gas exploration and production in the Beaufort sea and oppose the proposed Sale #97 in its entirety. The minimal, potential oil and gas resources that might be recovered from the proposed sale area simply do not warrant the risk of destroying this highly sensitive marine ecosystem. The risks inherent in oil and gas development are compounded by the fact that technologies for dependably safe exploration, production, and oil spill cleanup operations do not exist for conditions found in the proposed sale area.

At the very least, we recommend that the Pt. Barrow, Chukchi Sea, and Kaktovik Deferral Areas be removed from the proposed sale area. In addition we request that the DEIS be greatly improved so that the document can become a useful, accurate tool for assessing specifically which resources are likely to be impacted by the proposed sale. 21-71

Finally, it is of utmost importance that the public be given an opportunity to review the Biological Opinion required by the Endangered Species Act concerning the bowhead whale at the DEIS stage of the leasing process. We request that the comment period for the DEIS be extended or reopened prior to beginning work on the FEIS to insure that the public is not deprived of the right to assess the proposed sale in light of the information found in the Opinion and that the public's concerns on this issue are properly incorporated into the FEIS. 21-72

Thank you for this opportunity to comment.

Cindy Lowry

Cindy Lowry, Alaska Representative
Greenpeace, USA

Sue Libenson James Bamberger

Sue Libenson and James Bamberger, Boardmembers
Alaska Friends of the Earth

Robert W. Adler

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Alaska Wildlife Alliance

David McCargo Jr

David McCargo, Jr., Alaska Representative
American Wildlife Alliance

Susan Alexander

Susan Alexander, Alaska Regional Director
The Wilderness Society

Randy Rogers

Randy Rogers, Executive Director
Northern Alaska Environmental Center

Response 21-1

If commercial quantities were discovered in the sale area, recovery of oil from the reservoirs is estimated to take about 20 years; with secondary and tertiary recovery methods, this time could be extended. During the life of the field, or fields, the production of oil would provide for direct and indirect employment and pay a variety of taxes that would help support many local, State, and Federal programs. The EIS notes that natural gas is not deemed economical to produce at this time.

Also, see Response 21-68.

Response 21-2

The commenter has misinterpreted the probabilities provided in the EIS. For the proposal, there is a 6-percent (not 65-percent) chance of one or more spills of 100,000 barrels occurring (see Table IV-A-4). There is a 1-percent chance that one or more such spills would occur and contact land within 30 days in summer and a 2-percent chance that one or more such spills would occur and contact land over all of winter (see Tables IV-A-5 and IV-A-6). If such a spill were to occur and contact land, on the order of 90 kilometers (not at least 90 kilometers) would be expected to be oiled (see Sec. IV.A.2.b[2]). The greater than 99 percent and 24.4 spills cited by the commenter refer to the cumulative case of 9.255 billion barrels of resource and not to the 0.65 billion barrels of the proposal (Table IV-A-4). The log-normal-mean (not average) spill size associated with the expected number of 24.4 cumulative spills is 7,900 barrels. The log-normal-mean size for the expected number of 1.7 spills associated with the proposal is the slightly smaller 7,700 barrels (see Sec. IV.A.1.b[5]). The log-normal-mean size is an estimate of the median size of a spill, not the average size of a spill--this point has been clarified in Section IV.A.1.b(5).

Response 21-3

The cited 7-year toxicity of Prudhoe Bay crude was an example showing that weathering can be a slow process in the Arctic. The toxicity persisted in that study because the water body was a pond without a permanent outlet. Dispersion and dilution of spilled oil, not weathering, are the primary mechanisms that would lessen or limit toxicity of spilled oil in Arctic OCS waters.

Response 21-4

These concerns are addressed in Response 21-26. For additional information regarding (1) possible whale contamination in lead systems see Responses 7-10 and 7-14 and (2) for subsistence see Responses 7-3 and 8-23.

Response 21-5

For the proposal, the combined probabilities of one or more oil spills of 1,000 barrels or greater occurring and contacting Bowhead Spring Migration Corridors A and B (= the spring lead system) are 14 percent and 22 percent, respectively (see Table F-15). The probability of oil contacting one or both

of the two Spring-Migration Corridors is 33 percent (not 26-96% as stated by the commenter). The Barrow Deferral Alternative reduces this probability only slightly, to 31 percent.

Note that probability of habitat contact is not at risk. Risk takes into account the probability of habitat contact, whether important resources within that habitat would also be contacted by the oil, and what damage oil contact would do to that resource.

Response 21-6

This concern is addressed in Response 7-14.

Response 21-7

Figure IV-16 shows the study, spill-launch points, and endangered whale-habitat areas that are discussed in the oil-spill-trajectory analysis. The importance of the Plover Islands-Elson Lagoon for the marine and coastal birds is discussed in Sections III.B.3 and IV.E.3.

Response 21-8

This concern is addressed in Response 12-1.

Response 21-9

Deferral of the Kaktovik area from the lease sale would reduce the combined probability that an oil spill of 1,000 barrels or greater would occur and contact the Bowhead Fall-Feeding-Area B (shown on Fig. IV-16) during a 10-day open-water period from 3 percent to 1 percent. Bowheads feeding in or migrating through the deferral area would be less likely to be disturbed if the Kaktovik area were deferred. However, given the relatively low resource estimates for the sale and the relatively low level of exploration and production activities expected to result from the sale, it is not anticipated that whales using the Kaktovik feeding area would be disturbed substantially or exposed to a significant risk of an oil spill. A number of blocks nearby the deferral area already have been leased; consequently, whales using the feeding area are already subject to potential disturbance from OCS activities, although no significant degree of disturbance is believed to have occurred to date.

Response 21-10

This concern is addressed in Response 12-1.

Response 21-11

Research projects that are directly and indirectly related to the Chukchi Sea part of the Sale 97 area include the MMS-sponsored environmental and socioeconomic studies of the Arctic Region (USDOI, MMS, 1985); for studies planning, the offshore Alaskan Arctic Region is composed of the Beaufort and Chukchi Seas. Since 1974, 95 environmental studies and 29 social and economic studies have been conducted in the Beaufort Sea (formerly Diapir Field) Planning Area; the Alaska Beaufort Sea and the northeastern part of the

Chukchi Sea comprise this planning area. For the Chukchi Sea (formerly Barrow Arch) Planning Area, 86 environmental and social and economic studies have been conducted. Many of these studies provided the background material for the Barrow Arch Synthesis Meeting (Truett, 1984). The Arctic Region studies have provided environmental information and assessment for prelease and postlease activities.

Although fewer studies have been conducted in the Chukchi Sea than in the Beaufort Sea, information about the physical regimes or biological resources in one area can be useful in studying or analyzing an adjacent area with many similar features. The extrapolation of the information or the results of studies on one area to a similar area or on one species to another is an acceptable technique.

Also, see Appendix D.

As noted in Section II.A.3, the development and production scenario assumes that a production platform and an offshore pipeline will be located in the Chukchi Sea. These assumptions specifically were made to evaluate the effects of oil exploitation in the Chukchi Sea part of the Beaufort Sea Planning Area.

The concern regarding the estimated oil resources of the Chukchi Deferral Alternative is addressed in Response 12-1.

Response 21-12

As noted in Section II.B.1.b, laws, regulations, and orders that provide mitigation are considered to be part of the proposal. Thus, mitigating measures or parts of measures that duplicate existing laws, regulations, or orders are not analyzed in the EIS. The mitigating measures analyzed in the Sale 97 FEIS are very similar to the measures analyzed in the Sale 87 FEIS. Many of the measures, especially the ITL's, that appeared in the Sale 87 final NOS remind potential lessees of actions required under existing laws, regulations, or orders; examples of these ITL's are (1) Transportation, Siting and Location of Oil Loading Facilities; (2) Offshore Pipelines; (3) Collecting Information on Ice; and (4) Shallow Hazards Seismic Survey. In addition, the requirements of some stipulations are changed as significant new information about the subject of the measure becomes available. Proposed mitigating measures that are addressed in the EIS should either eliminate or mitigate potential effects to the environment caused by the proposed action.

The mitigating measures in the Sale 97 EIS were analyzed to address some of the major scoping issues noted in Table I-D-1.

If the Secretary decides to conduct a lease sale, there are several steps remaining in the leasing process that must be taken before the sale can be conducted; these steps are described in paragraphs 11 through 13 of Section I.A. As noted in these paragraphs, the Secretary reaches the final decision regarding the proposed sale after considering other new pertinent information and the recommendations of the Governor of the State of Alaska. Other mitigating measures can be proposed prior to the final decision.

Response 21-13

Based upon data from 8 years of aerial surveys designed to document the bowhead whale migration, fall-migrating bowheads have never been observed in the western blocks before September 15. As noted in Stipulation Number 4, the actual dates when exploratory drilling or other downhole exploratory activities will be prohibited are set by the RSFO; this decision is based on the best information available concerning the presence of bowhead whales in the area. Consequently, if fall-migrating bowheads were to enter the western blocks prior to September 15, the area would be closed to drilling when the bowheads arrived.

Response 21-14

For Sale 87, the Transportation of Hydrocarbon Products Stipulation contained a paragraph that reiterated an existing regulation. Stipulations or parts of stipulations that duplicate existing laws, regulations, and orders have been omitted. As noted in Section II.B.1.b, laws, regulations, and orders that provide mitigation are considered part of the proposal.

Response 21-15

Provisions of the OCSLA, as amended, require the use of the best available and safest technologies (BAST) for all OCS operations, including oil-spill cleanup. The Oil-Spill-Cleanup Capability Stipulation for Sale 87 was proposed at the PNOS step in the leasing process, Section I.A.11, and adapted as a stipulation for the leases awarded as a result of Sale 87. The effectiveness of this stipulation was not evaluated in the Sale 87 EIS. As noted in Section I.A.11, laws, regulations, and orders that provide mitigation are considered part of the proposal. Other requirements can be considered in each lease resulting from Sale 97 through negotiations with the Governor of the State of Alaska pursuant to Section 19 of the OCSLA, as amended.

Also, see Response 21-12.

Response 21-16

The monitoring program has been funded for the past 8 years and is currently projected to continue in the future. The accumulated data from the monitoring program has provided MMS with a good database to predict the general timing and location of the bowhead migration.

Response 21-17

This concern is addressed in Response 21-12.

Response 21-18

The RRT for Alaska reevaluated its position on the use of dispersants in waters offshore of Alaska and reached a consensus that dispersants could be considered as a first line of defense. The RRT has already given preapproval to the OSC to use dispersants as a first line of defense in parts of Cook Inlet and currently is considering similar preapproval for the Beaufort Sea areas. Thus, the premise set forth in previous ITL's about lack of agreement about dispersant use as a first line of defense is no longer correct and has been eliminated from the proposed ITL.

Response 21-19

The loudest sounds associated with OCS activities are produced by the deep seismic surveys that normally occur prior to a lease sale. As stated in the referenced ITL (ITL No. 7), Notice to Lessees No. 86-2 specifies performance standards for these activities and was derived from the reasonable and prudent alternatives contained in NMFS biological opinions for the Beaufort Sea Planning Area. Consequently, lessees abiding by these measures should not take bowhead whales. MMS will be kept appraised of bowhead whales present in the proximity of OCS exploration activities and any apparent or anticipated adverse effects upon these whales, and the Regional Supervisor, Field Operations, will limit or suspend such activities should it appear that a number of whales could be adversely affected such that the species might be jeopardized.

Response 21-20

ITL's are proposed for the purposes of either (1) stating MMS policy and practices that are carried out and enforced, (2) informing lessees about special concerns in or near the lease area, or (3) advising or informing lessees of existing legal requirements of MMS and other Federal agencies. The ITL's and stipulations discussed in the Sale 97 EIS have been proposed to address some of the major scoping issues noted in Table I-D-1.

Also, see Response 21-12.

Response 21-21

In 1979, the Council on Environmental Quality (CEQ) promulgated regulations aimed at reducing the size and complexity of EIS's produced by the Federal government; however, such reduction is not to affect the quality of the analysis. In place of extensive discussions of the environment and many site-specific descriptions, the EIS contains numerous citations and incorporates by reference EIS's written for past lease sales within the same planning area and pertinent reports. The draft EIS for Sale 97 contained approximately 530 citations; about 150 of these citations are for the years 1984 through 1986 (the Sale 87 FEIS was published in March 1984). Because the locations of oil resources, exploration wells, production platforms, or pipelines are unknown, site-specific discussions are not emphasized. Site-specific information is contained in many of the documents cited in this EIS, and the documents are incorporated by reference. The exploration plans and development and production plans submitted in accordance with 30 CFR 250.34 will contain information about specific sites affected by the facilities; the public is provided an opportunity to comment on these plans.

Also, see Responses 6-2 and 6-3.

Response 21-22

The cited discussion states that multiple spill contacts are considered for those species that are migratory; potential effects are not downplayed by such consideration.

Response 21-23

The analyses in the EIS's are based on the best-available scientific information. As discussed in the various sections, this information provides the bases for the judgments on how the proposed action may affect the biological resources, sociocultural systems, or physical regimes in and near the planning area. The results of each of the analyses are summarized in (1) the CONCLUSION parts of Sections IV.B.1-13, IV.D.1-13, IV.E.1-15, IV.F.1-15, and IV.G.1-15; (2) Table II-C-1, Summary and Comparative Analysis of Potential Effects for Alternatives I, IV, V, and VI for Beaufort Sea Sale 97; and (3) in Table S-1, Summary of Effects for the Proposal and Deferral Alternatives. If only these summaries are read, the conclusions may seem speculative; however, the bases for these conclusions are analyzed in the discussions of the effects of the proposed action on the various resources (Sec. IV.B).

Response 21-24

The MMS does not consider statements regarding the probability of bowhead whales habituating to stationary, constant noise sources of moderate volume to be purely speculative. Rather, we have attempted to make a good-faith effort to discuss effects that are reasonably foreseeable based upon evidence from whale behavior in other areas. Habituation--generally thought to be the simplest form of learning--is evident in many animal groups including a number of primitive animal species. It involves the relatively permanent reduction or elimination of a response in the absence of any overt reward or punishment. The significance of habituation is that it permits individuals to discard a normally useful response when it becomes an inappropriate, time- and energy-consuming activity. However, habituating mechanisms are highly selective so that the animal retains its ability to use the behavioral response in all but a few safe conditions (Alcock, 1975).

Examples of habituation and other forms of learned behavior are abundant among cetaceans. Dealing specifically with baleen whales, Watkins (1986) described the changes in the reactions of four species of baleen whales to human activities in Cape Cod waters over a period of 25 years. He stated that whales responded negatively to underwater sounds that appeared to be unexpected, too loud, suddenly loud or different, or perceived as associated with a potentially threatening source (e.g., a rapidly approaching ship or outboard on a collision course). Sounds that were continuing (e.g., an engine that had been running at a particular rate for some time) generally did not cause a reaction. Also, whales often seemed to become accustomed to sounds that appeared to be bothersome at first. Habituation to stimuli occurred rapidly; sometimes only a few encounters were needed to transform a whale's wariness to apparent concern. Also, when whales concentrated on feeding or social activity, they often ignored other usually disturbing stimuli. Over years of exposure to ships, for example, the reactions of (1) minke whales have changed from frequent positive interest to generally uninterested reactions, (2) fin whales have changed from mostly negative to uninterested reactions, (3) humpbacks have changed from mixed responses that were often negative to often strongly positive reactions, and (4) right whales have continued the same variety of responses with little change. One point worth noting is that no species changed its behavior to more actively avoid vessels. OCS exploration and production facilities have been in place in the Santa Barbara Channel off California for many years. Gray whales migrate through this area annually. There have been no published studies on distances of closest approach, but individuals who routinely work on OCS platforms in this area state that gray whales commonly migrate past platforms at close range (within a couple of kilometers). Brown (1986) quotes one oil worker as stating that he has seen whales swim right past the platform and even under the platform heliport. After considering this evidence and the fact that bowheads have been sighted in the vicinity of drillships and dredges in the Canadian Beaufort Sea (Richardson et al., 1985), we see no reason to assume that bowheads would not habituate to OCS noise sources such as production platforms that are stationary and that produce sound at moderate levels and at a relatively constant volume and frequency.

Response 21-25

This concern is addressed in Response 7-13.

Response 21-26

As discussed in Responses 7-10 and 7-14, the discussion in Section IV.B.5.b on the effects of oil spills on bowhead whales is applicable to the spring lead system as well as other areas and seasons. We continue to believe that the effect of the proposal on the bowhead whale will be MINOR with no greater than MODERATE effects in the cumulative case.

The disparity between the effects on the bowhead whale as a resource and the effect on the subsistence harvest of the bowhead whale are due to the different factors used in these very different analyses. The analysis of the resource examines the effects on the regional population of the species, while the subsistence-harvest analysis is concerned with a reduction in the harvest. Unlike other subsistence species, the bowhead whale harvest is very small. In most communities, fewer than three--and often only one--bowhead whales are harvested each year. With such a small number harvested, any reduction in the harvest would be a major reduction or possibly the elimination of the entire harvest. If such an event were to occur for more than 1 year, the effect on the harvest of the bowhead whale would be MAJOR.

See also Responses 10-7 and 21-5.

Response 21-27

Assessments of noise and disturbance effects on bowhead whales were mostly based on observations by Richardson et al. (1985). Bowheads that appeared undisturbed were observed on several occasions within 4 to 20 kilometers of operating drillships in the Canadian Beaufort Sea. Playback experiments showed that some bowheads reacted, although not strongly, to drillship noise at intensities similar to those expected several kilometers from an actual drillship. A study by Miles et al. (1986), which became available after the DEIS was published, provides some preliminary estimates of distances at which bowheads would react to drillships in the Alaskan Beaufort Sea. It should be

noted that the distance at which bowheads would react to drillship operations would probably be influenced by support-vessel activities around the drillship, sound-propagation characteristics of the drill-site area, and ambient-noise levels. Under mean ambient-noise conditions, the preliminary estimates are that about 50 percent of bowhead whales migrating past a drill site would probably react to drillship operations at a distance of 1.3 to 2.5 kilometers with the possibility that a few whales may respond at 5.5 to 11.0 kilometers.

The concern regarding habituation is addressed in Response 21-24.

Experiments conducted by Geraci and St. Aubin (1982, 1985) demonstrated that dolphins were capable of detecting and avoiding thick patches of oil both visually and through tactile sense. Most gray whales migrating through oil-seep areas off the California coast were observed to swim through oil, modifying their swimming speed but without a consistent pattern. Some whales changed direction when approaching oil, and some whales in oil-contaminated areas seemed to spend less time at the surface, blowing less frequently but at a faster rate. These behaviors may suggest that some whales can detect oil while others either could not detect it or were indifferent to it. Geraci and St. Aubin (1986) conclude that bowheads seem to have the visual capability of detecting oil, which sufficiently alters the optical properties of the surface, and may also be able to detect oil on their body surface. Consequently, it would appear that bowheads are capable of detecting thick patches of oil and might avoid it if they find it annoying.

There would be 9-percent probability of an oil spill of 1,000 barrels or greater occurring and contacting the bowhead Fall Feeding Area B within 10 days following the spill (Appendix F, Table F-19). As discussed in the FEIS, only those areas having a 10-percent probability of contact or greater were specifically mentioned in the referenced discussion. Probabilities of oil-spill contact for other areas are contained in Appendix F.

Response 21-28

Graphic 4 has been revised to include known gray whale-concentration areas. These areas should be considered as the most important areas for feeding. Gray whales observed between Point Barrow and Point Hope were a mean distance of 14.5 kilometers from shore at a mean depth of 20.5 meters. Feeding was the behavior most often reported for these whales (54%) (Moore, Clarke, and Ljungblad, 1986). Three genera of amphipods, Ampelisca, Anonyx, and Pontoporeia, present in the stomach of any gray whales taken along the northern coast of the Chukchi Peninsula appear to be preferred prey, although there usually is a variety of prey species in the stomach (Blokhin and Pavylechkov, 1983). These three genera are found along the Alaskan Chukchi Sea coast; however, extensive sampling has not been done in this area (Stoker, 1981), and we are not sure to what extent gray whales rely upon this prey base off the Alaskan coast.

Response 21-29

Graphic 2 has been revised to address this concern.

Response 21-30

Graphic 4 has been updated to include gray whale-concentration areas.

Response 21-31

We believe that cumulative effects on the gray whale will not exceed the MODERATE level as defined in Table S-2 of the EIS.

The MMS believes that the mitigating measures and the process for reviewing site-specific exploration plans and development and production plans will ensure gray whales are protected as required by the Marine Mammal Protection Act and the Endangered Species Act of 1973, as amended.

Response 21-32

Table II-C-1 is a brief summary of the conclusions on the effects of the proposal and the alternatives on marine mammals and other resources. The possibility of an oil spill contacting the open lead system and the effects of oil contact with belugas are discussed in Section IV.B.4.a(2)(e). MINOR effects of oil spills on beluga whales or other marine mammals that may result in temporary avoidance of a spill could have a significant effect on the subsistence use of that resource for 1 year, which would be a MAJOR effect.

Also, see Responses 7-10, 10-7, and 21-5.

Response 21-33

Important summer habitats or concentration areas used by beluga whales are clearly shown in Graphic 4. Belugas migrate through the Sale 97 area within the active ice zone shown on this graphic; thus, there are no summer-concentration areas of beluga whales within the proposed Sale 97 lease area. The specific migration routes used vary greatly from year to year and season to season depending on ice conditions.

Response 21-34

In Section III.B.4, the percentages of the species populations that potentially may be affected include the entire portion of the population occurring in the Sale 97 area as given for each species description in Sections III.B.4.a to .c. The numbers of each species found at "specific locations" within the proposed sale area vary greatly from season to season and even from day to day. For example, the number of beluga whales in the lead system off Point Barrow can range from zero to several thousand. Thus, no meaningful numbers of seals, whales, or polar bears can be given on Graphic 4 for specific locations. Adequate information on the effects of oil spills and noise disturbance specific to each species when and where the effect applies is discussed in Sections IV.B.4.a(1) and (2), respectively.

Response 21-35

Ringed and bearded seal habitats occur throughout the entire Sale 97 area. The floating fast-ice zone used for ringed seal pupping is shown on Graphic 4. The importance of specific portions of the fast-ice zone in regard to seal

densities varies from year to year depending on ice conditions. Thus, the importance of any fast-ice-habitat areas from Point Barrow to Demarcation Point varies from year to year; no local habitat for ringed or bearded seals can be considered more important than other local habitats in the sale area.

Polar bears also use the entire Sale 97 area. Polar bear maternal dens can occur anywhere within this area depending on ice conditions and the season. The active ice zone, shown in Graphic 4, is particularly important to polar bears. The majority of the dens in the sale area occur offshore on the moving sea ice as discussed in Section III.A.4.b. For example, a female polar bear may enter a den on the sea ice offshore of Kaktovik-Camden Bay in November or December and leave the same den offshore of Point Barrow in the early spring, March to April.

The great natural variation in the distribution of pinnipeds, polar bears, and beluga whales indeed does make it difficult to accurately measure the potential risks of marine mammal interactions with oil spills or noise-disturbance sources.

Response 21-36

This concern is addressed in Response 2-3.

Response 21-37

In Table IV-B-1, "pelagic" has been changed where appropriate; in the discussion in both Sections III.B.2 and IV.B.2, these fish were already described as being coastal. A spill in neashore waters, although it could affect fish locally, is not expected to devastate stocks. See the expanded discussion in Section IV.B.2.

Response 21-38

The analysis in the DEIS did not just discuss effects to juvenile fish; however, previous studies have suggested that larval and juvenile fish are much more likely to be affected than are adults. Therefore, parts of the analysis emphasized potential effects to eggs, larvae, and juvenile fish. Juvenile fish are not just one year class, as suggested. The analysis in Section IV.B.2 has been expanded to further address potential effects to multiple age classes of fishes in the neashore zone.

Response 21-39

In the analysis of potential oil-spill effects on fishes, additional information and analysis has been included on the abundant arctic anadromous fishes (e.g., arctic cisco, arctic char, least cisco, and broad whitefish). Emphasis on pink salmon as an example of an anadromous fish has decreased, but capelin are still discussed in some detail even if they are not viewed as being "important," since their life history means they are vulnerable to effects while in coastal environs.

Response 21-40

The considerations stated were addressed in the EIS in the assessment of potential effects to pelagic, benthic, and epontic communities, Section IV.B.1.

Response 21-41

The probability of a large (100,000-barrel-or-greater) spill occurring is stated in the EIS, and the analysis of effects, which are not expected to differ except in areal extent from a smaller spill, are also related. An elaborate discussion is not made because the predicted level of effects is the same. The effect of a large spill occurring during the early spring when the epontic community may be the major source of food available to planktonic forms is not expected to exceed MINOR for benthic communities. The effects of a winter oil spill melting out in the spring have not been considered separately from those of an open-water spill because the spills should behave similarly.

Response 21-42

Invertebrates are not the basis of the entire ecosystem. Rather, the bases are primary producers in the form of phytoplankton, algae, and terrestrial plants. Shifts in invertebrate composition may be persistent if sediments become contaminated. However, because of the limited spatial scale of effects and other factors detailed in the analysis, the effect on benthic invertebrates from oil spills is expected to be MINOR.

Response 21-43

The description of the sea-ice conditions in the Sale 97 EIS is a summary of the description from the Sale 87 FEIS that is incorporated by reference. The formation of ridges and the movement of various sea-ice features are part of the sea-ice description. The Sale 87 FEIS also references a report in which examples of historic ice conditions along the Beaufort Sea coast are related through interviews and personal narratives of local residents.

The Alaska OCS Orders of the Minerals Management Service Governing Oil and Gas Lease Operations on the Alaska Region Outer Continental Shelf implement the safety and pollution prevention measures that the lease operators are required to follow by law. It is through these OCS Orders that standards are set for (1) the design, fabrication, and installation of bottom-founded units or fixed platforms or other structures and (2) all activities associated with drilling and producing activities. Order No. 2 requires that the lease operator submit evidence that the drilling unit is capable of withstanding the oceanographic, meteorologic, and ice conditions for the proposed area of operations. Order No. 8 states that all new bottom-founded platforms shall be subject to review under the Platform Verification Program. This review is done by an independent third party who has the technical expertise to evaluate the structures.

The discussion of sea ice is descriptive because, as noted in Section IV.B.3.a, many factors influence the magnitude of the forces that ice can exert on any structure; and, furthermore, some of the information needed to evaluate the capability of a manmade structure is proprietary and thus not

available to the public. In addition, the technologies that have been and are being developed to operate in the sea-ice environment in the Beaufort Sea are discussed in Section III.B.3.a. This format should provide the reader with general background information concerning sea ice and technologies.

Response 21-44

Fault zones are shown in Figure III.5. The text has been amended to address this concern; see Section III.A.1.b(5).

Response 21-45

The technologies and strategies that have been and may be used to exploit the oil and gas resources of the Alaskan Beaufort Sea are discussed in Section IV.A.3. Technology does exist for oil-spill response in the Beaufort Sea, but its effectiveness is limited. This point is discussed in Section IV.A.2.

Response 21-46

The technologies and strategies that have been and may be used to explore for the petroleum resources of the Alaskan Beaufort Sea are discussed in more detail in the Sale 87 FEIS. The description of the constraints and technologies in the Sale 97 EIS, Section IV.A.3, is a summary of the description from the Sale 87 FEIS that is incorporated by reference. The summary in the Sale 97 FEIS has been augmented with new information.

In waters shallower than about 15 to 20 meters, artificial islands have been used to explore for oil and gas. However, in deeper waters, drilling units that can be moved to other sites provide an economical advantage over artificial islands. Artificial islands could be built in waters deeper than 20 meters, but with the development of other types of units, they probably will be limited to the shallower waters.

Ice-strengthened drillships have been used to drill three wells in the Alaskan Beaufort Sea (Sec. IV.A.3). Furthermore, floating units, such as drillships and semi-submersibles, have been used to drill in waters deeper than 300 meters in other parts of the world. Thus, floating units--with ice-strengthened hulls and an ice-management program--could drill exploration wells in the deeper waters of the outer part of the Sale 97 area.

Technologies for production platforms are summarized in Section IV.A.3 and discussed in more detail in the Sale 87 FEIS; this discussion is incorporated into the Sale 97 EIS by reference.

Also, see Response 21-43.

Response 21-47

This concern is addressed in Responses 21-43 and 21-46.

Response 21-48

Pipeline leaks would be identified as they are elsewhere on the OCS and as in Cook Inlet: by pipeline-pressure sensors and flow meters in addition to visual inspections during open water. Visual inspections are not the primary means of detecting major oil spills. The largest OCS spill in history, a pipeline spill of 160,000 barrels in the Gulf of Mexico, was identified through flow measurements; it was never visually spotted. The likelihood of pipeline spills is incorporated in the oil-spill-risk analysis and possible effects of spills--including pipeline spills--are considered in the EIS.

Response 21-49

Most of the proposed Sale 97 blocks lie in waters deeper than 20 meters. Thus, it is expected that most of the exploration wells will be drilled from mobile bottom-founded or floating drilling units. Installation and operation of these units will not necessitate the construction of causeways. As noted in Section II.A.2, it was assumed in the EIS that one artificial island would be constructed in waters shallower than 20 meters and that the method of construction would be similar to that used for Mukluk. As part of the Mukluk project, two piers were constructed from the southwest side of Thetis Island in waters out to depths of about 3 or 4 meters. One pier was about 150 meters long and the other about 120 meters long. Thetis Island--which is located west northwest of Olitkok Point and about 8 kilometers from the Colville River Delta--is migrating southwest at a rate of about 4 to 7 meters per year. Thus, the piers are located in an area of change and are considerably shorter than some of the existing or proposed causeways along the Beaufort Sea coast: the West Dock, in Prudhoe Bay, is about 4 kilometers long; the Endicott causeway is about 5 kilometers long; and the proposed causeway for the offshore part of the Lisburne Development Project is about 4 kilometers long.

As noted in Appendix G, Table G-9, 16 artificial islands have been constructed in State and Federal waters of the Beaufort Sea, 13 of which were constructed by hauling gravel from onshore deposits to the construction sites over ice roads; piers or causeways were not required for the construction of these islands. Two islands, Resolution and Endeavor, were constructed on the delta of the Sag River by hauling onshore gravel in barges to the construction sites; the barges were loaded from an existing causeway at Prudhoe Bay. The piers used to construct Mukluk have been previously discussed.

To transport produced oil from the Endicott Reservoir, a causeway was constructed from the production islands to the shore. These production islands are located in State of Alaska waters inside the barrier islands at depths up to about 4 meters.

Federal offshore blocks in the Sale 97 area lie from 5 to 260 kilometers offshore. As shown in Figure I-1, many of the nearshore blocks already have been leased; thus, the platforms installed to produce Sale 97 oil are likely to be installed more than 5 kilometers offshore and in waters deeper than 20 meters. These factors preclude the use of long causeways to protect pipelines carrying oil from the production platforms to onshore sites.

Furthermore, it is anticipated that offshore pipelines will be buried in trenches below ice-gouge depth in those areas where ice movement is a threat. These trenches could extend through the nearshore zone onto the shore. Alternative approaches to a pipeline shore crossing, as noted in Section IV.A.3.a(3)(a), include boring (directional drilling) through the sediments or covering with a strong material (causeway). If used to protect a pipeline crossing the shoreline, it is anticipated that such a causeway will be much shorter than the Endicott causeway. If permafrost is encountered along a route, the pipeline (1) can be provided with sufficient insulation to restrict the thawing of the permafrost and the resulting settlement to an acceptable amount or (2) rerouted (Sec. IV.A.3.b[1]).

As indicated above, the construction of a causeway is not anticipated under the development scenario, but if one is constructed, it is likely to be very short. The choice of particular plans during development and production depends on analysis of very site-specific issues. At that point, more specific information regarding oceanographic regimes, biological resources that could be affected, etc., can be taken into account. Also, if a short causeway or jetty were decided upon, mitigating measures to minimize potential effects (e.g., the inclusion of sufficient breaching; U.S. Army Corps of Engineers and Environmental Research and Technology, Inc., 1984) could be adopted. Construction of a causeway would necessitate permitting by the U.S. Army COE, which could require further analysis of the proposed action via an EIS or EA, and which could choose not to permit such a structure.

Response 21-50

Oil spills are not an integral part of development activities, and the discussion of oil-spill cleanup is more appropriately considered in Section IV.A: Environmental Consequences, Basic Assumptions for Effects Assessment, along with the oil-spill-risk analysis and other aspects of oil spillage.

Section IV.A.2.c is a summary of a more extensive discussion in Appendix C. The reader is provided with both discussions on and conclusions about the effectiveness of oil-spill response at sea. Oil spills are not assumed to be cleaned up at sea in the analysis of effects of oil spills. The risks to resources of the Beaufort Sea posed by oil spills are evaluated for the reader in Sections IV.B through IV.I.

Response 21-51

The text in Sections IV.A.1.d(1), (2), and (4) has been amended to address these concerns.

This concern is also addressed in Response 21-50. In addition, the quotation from Section IV.A.2.c provided by the commenter does not support the premise that the analysis overrates the ability to respond to spills.

Response 21-52

The text in Sections IV.A.1.d(1), (2), and (4) has been amended to address these concerns.

Response 21-53

The influences of logistics and other factors are already considered in evaluating the effectiveness of oil-spill response in Section IV.A.2.c. The conclusions about effectiveness of response are empirical, based in large part on the actual recovery of oil in real spill events, under real logistical constraints.

Consideration of logistical timing by itself can be misleading. Because the first-strike-response team is usually made up of onsite personnel who use equipment stored on site, logistics do not play a role in initial oil-spill response, particularly for platform spills. In addition, delays in responding to spills on ice or even under ice will not necessarily affect the amount of oil ultimately recovered (or burned) because the ice retards the spreading and dispersion of the oil (see Sec. IV.A.2.a). One of the more promising techniques for cleanup of under-ice spills--one that has been demonstrated as effective for at least first-year ice--is to wait until the oil melts out onto the ice surface in late spring and then burn and/or manually remove the oil.

Response 21-54

Specific areas of critical habitat are delineated in the oil-spill-trajectory model based on best-available information. The oil-spill-trajectory model is state-of-the-art, and extra effort has gone into ensuring that assumptions do not downplay risk. For example, no weathering, dispersion, or cleanup of oil is assumed in the model. Consideration of these three factors could show that the size of a modeled oil spill would be reduced to negligible size before a target was contacted by the spill. In addition, trajectories for spills are tracked in Arctic models for up to 10.5 months in order to account for lack of weathering of oil in winter ice. Oil-spill models for all other U.S. OCS areas limit trajectories to a 30-day duration.

Response 21-55

The oil-spill-risk analysis does consider the possibility of oil contacting the Canadian shoreline, including the MacKenzie River Delta (see Fig. IV-1), taking into account spill risk from both U.S. and Canadian oil development. However, the analysis indicates that neither the proposal nor the cumulative case (including offshore Canadian development) pose significant likelihood of contact to Canadian shoreline (Sec. IV.A.2.b).

In the DEIS for Sale 97, the cumulative oil-spill risk from Sale 109 was analyzed separately from the results of the oil-spill-trajectory model because trajectories were not available for the Sale 109 area (see Sec. IV.A.1.a and Table IV-A-4). Since the publication of the Sale 97 DEIS, an oil-spill-risk analysis (OSRA), including the cumulative case, has been completed for the Sale 109 DEIS (MMS, Alaska OCS Region, 1987). This analysis is incorporated by reference and summarized in the Sale 97 FEIS in Section IV.A.1 and elsewhere when used by analysts in determining possible cumulative effects for Sale 97.

Response 21-56

As discussed in Section IV.A.1, the OSRA is based on known, historical spillage of 1,000 barrels or greater for international tankering for tanker spills (cumulative case only) and on the U.S. OCS for platform and pipeline spills. In particular, any major spills on the U.S. OCS by industry must, by regulation, be reported to MMS. The MMS considers its spill record complete, is not aware of any major spills that are not included in the MMS spill-event files, and would appreciate any documented evidence for unlisted spills that the commenter could provide. Note that underreporting of spills would likely cause the EIS to overestimate rather than underestimate spill size: larger spills are more readily detectable than smaller spills and, therefore, are less likely to be underreported than are smaller spills.

Response 21-57

Section IV.A.1.a has been amended to address this concern.

Response 21-58

Oil spills from State sales can only be considered qualitatively in the EIS. The State of Alaska provides neither spillage estimates nor resource estimates that could be converted into an estimate of the probability that spill(s) would occur. However, State sales can be considered in the OSRA in the context of what would happen to a spill if one occurred. For example, it is evident from Figure IV-9b that if a spill were to occur in the State Sale 55 area, there would at least a 33-percent chance that the spill would contact land within 10 days.

Response 21-59

Subsistence-resource areas are not excluded from the OSRA. These areas are covered by the land segments (Fig. IV-1) used in oil-spill-trajectory analysis.

Response 21-60

Oil spills are modeled as suggested by the commenter (see Sec. IV.A.1.c). The referenced discussion in Section IV.A.2.b has been clarified.

Response 21-61

The referenced analysis of effects of the proposal on caribou does include a discussion of the effects of an onshore pipeline across NPR-A on the Western Arctic caribou herd--see Section IV.B.6.a(3)(b).

Response 21-62

For Sale 97, Section II.A.4, the assumed onshore pipeline across NPR-A would be routed far south of the Teshekpuk Lake special study area designated by BLM and therefore would avoid effects on this special habitat area. A possible onshore pipeline from Camp Lonely could occur in the cumulative oil-development case; see Section IV.B.6.b(3).

Response 21-63

This concern is addressed in Response 2-10.

Response 21-64

Although air quality was not regarded as a major scoping issue (Table I-D-1), MMS is aware of onshore air-quality concerns and has tried to reasonably assess their effects as a separate issue. Sufficient information and analyses are included in the text to evaluate air-quality effects and to demonstrate that potential effects are MINOR. Section IV.B.15 includes analyses of both direct and indirect air-pollutant emissions from the proposed action and its alternatives.

Response 21-65

The text of Sale 97 EIS Appendix A, Alternative-Energy Sources as an Alternative to the OCS Program, has been replaced with material prepared by MMS for the Alternative Energy Sources Appendix in the Proposed 5-year OCS Oil and Gas Leasing Program Mid-1987 to Mid-1992 FEIS.

Response 21-66

This concern is addressed in Response 1-4.

Response 21-67

As noted in Table I-D-1, MMS considers subsistence fishing to be a major scoping issue. In addition to material already presented, the text has been amended to address this concern; see Sections III.C.3.b(1)(g), (2)(g), (3)(g), and (4)(g). According to Alaska Consultants, Inc. et al. (1984, p. 555) and Craig (1984a, p. 272, Fig. 6) arctic char is harvested by Barrow residents.

As noted in Section III.C.3, the subsistence-harvest-pattern descriptions of Barrow and Atqasuk have been combined because (1) Atqasuk's subsistence-use area is virtually enclosed in Barrow's, (2) Atqasuk hunters often harvest marine mammals with Barrow hunters, and (3) much of the available literature discusses the two communities together.

Response 21-68

Under the OCSLA, as amended, the Secretary of the Interior shall select the time and location of leasing, to the maximum extent practical, so as to obtain a proper balance between the potential for environmental damage, the potential for the discovery of oil and gas, and the potential for adverse effect in the coastal zone. In making a decision concerning the timing and location of any proposed offshore lease sale, the information obtained during the various steps in the leasing process, as outlined in Section I.A, up to the Proposed Notice of Sale, is evaluated by the Secretary. This information includes (1) the major issues; (2) proposed alternatives and mitigating measures; (3) the potential for petroleum discoveries; (4) potential economic, environmental, and social consequences; and (5) subsequent exploration and development and production activities.

If the Secretary decides to conduct a lease sale, there are several steps remaining in the leasing process that must be taken before the sale can be conducted; these steps are described in paragraphs 11 through 13 of Section I.A. As noted in these paragraphs, the Secretary reaches the final decision regarding the proposed sale after considering other new pertinent information and the recommendations of the Governor of the State of Alaska.

Response 21-69

These concerns are addressed in Section I.B.3.e.

Response 21-70

This concern is addressed in Section I.B.3.e.

Response 21-71

The Secretary of the Interior has the option of deferring from the Sale 97 proposed area any or all of the deferral areas analyzed in the FEIS or areas proposed after consultation with the Governor of Alaska, pursuant to Section 19 of the OCSLA, as amended.

Response 21-72

This concern is addressed in Response 7-13.

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Congressman Don Young
Governor Bill Sheffield

December 29, 1986

Regional Director, Alaska OCS Region
Minerals Management Service
Attention: Dick Roberts
949 East 36th Avenue, Suite 110
Anchorage, AK 99508

Re: Beaufort Sea Sale 97 EIS

Gentlemen:

The Resource Development Council appreciates the opportunity to comment on the Draft Environmental Impact Statement for the Beaufort Sea Sale 97 scheduled to be held in January of 1988.

The Resource Development Council for Alaska, Inc. is a statewide private development organization. Its members come from all economic sectors---business, labor, local government, universities and a wide range of statewide associations. RDC focuses on the most serious economic challenges facing Alaska.

The Council strongly encourages the Minerals Management Service to proceed as scheduled with the Beaufort Sea Sale 97 in January 1988. We find no information or analysis within the DEIS that supports arguments in favor of delays, additional regulation of industry activity or acreage deletions. In fact, we feel the stipulations and conditions proposed in the DEIS may be unreasonable in light of available technology and extensive Beaufort Sea experience.

The proposed sale acreage includes some of the most promising unleased oil and gas lands owned by the federal government. Earlier Beaufort Sea lease sales as well as the state's proposed Camden Bay lease sale and Arctic National Wildlife Refuge have all generated substantial industry interest. If the United States intends to support a healthy, growing petroleum industry, it must consistently lease promising acreage such as Sale 97.

America's reliance on Alaska oil is well documented. What is not as well known is that production from existing Alaskan fields will start an unavoidable decline in the very near future. Unless we allow new, promising acreage to be explored and potentially produced, this decline may never be reversed. Given the long time lags between lease sales and potential production in the Arctic, it is imperative that the U.S. maintain an aggressive, consistent OCS lease schedule.

There will undoubtedly be opposition to this lease sale--as there has been to all Arctic offshore lease sales. We ask only that the industry's solid environmental performance be taken into account. Through demonstrated applications of existing technology, industry has consistently demonstrated its ability to protect the Beaufort Sea ecology.

The Resource Development Council encourages the Minerals Management Service to proceed as scheduled with this lease sale. A predictable lease schedule is in the best interests of the nation and must be adhered to if our economy is to advance.

Sincerely,

RESOURCE DEVELOPMENT COUNCIL
for Alaska, Inc.

Paula Easley

Paula P. Easley
Executive Director

cc: Governor Steve Cowper
Bob Arnold, Department of Natural Resources
George Ahmaogak, North Slope Borough
Jacob Adams, Arctic Slope Regional Corporation
William Hopkins, Alaska Oil and Gas Association
Senator Jack Coghill, Senate Resources Committee
Congressman Don Young, U. S. House of Representatives
Senator Frank Murkowski, U. S. Senate
Senator Ted Stevens, U. S. Senate

C. Public Hearing Comments and Responses

Public hearings on the Sale 97 DEIS were held in the following Alaskan communities in December 1986: Anchorage on the 17th, Barrow on the 8th, Kaktovik on the 11th, Nuiqsut on the 11th, and Wainwright on the 9th. Because of the volume, transcripts of the oral testimonies are not reproduced in the EIS; instead, significant issues discussed by the speakers have been excerpted and presented in this section. (A copy of the transcript is available at the Alaska OCS Region Office, Public Information Library, in Anchorage.) At the hearings in the NSB communities of Barrow, Kaktovik, Nuiqsut, and Wainwright, MMS arranged for the services of a translator to translate testimony spoken in Inupiaq to English for the hearing record. Also, the testimony spoken in English was translated to Inupiaq for the benefit of the audience.

Speakers and their excerpted testimony are listed in the order of their appearance.

Anchorage Public Hearing

1. Cindy Lowry, Alaska Field Representative for Greenpeace
2. Ginny DeVries, Staff Representative for Alaska Wildlife Alliance
3. Sue Libenson, Alaska Friends of the Earth
4. Mike Matz, Associate Field Representative of the Sierra Club
5. William W. Hopkins, Executive Director, Alaska Oil and Gas Association
6. Bill Oppen, Director of Policy and Intergovernmental Relations, Government of Yukon
7. Randy Stilley, Representing National Ocean Industries Association and Alaska Support Industry Alliance
8. Rob Dragnich, Engineering Coordinator, Exxon Company, U.S.A.
9. Barbara Johnson, National Audubon Society
10. Dave Yesland, Manager, Regulatory Affairs, Shell Western E&P Inc.
11. Mike Abbott, Resource Development Council for Alaska

Barrow Public Hearing

(*Speaker Testified in Inupiaq--Translator, Mabel Panigeo)

1. James Savok, Jr., NSB, Planning Department
2. Charles D. N. Brower, NSB, Department of Wildlife Management
3. Ron Nalikak, Administrative Director, AEWC
4. Billy Adams, NSB, Department of Wildlife Management
5. Tom Albert, NSB, Department of Wildlife Management
6. Mike Philo, NSB, Department of Wildlife Management
7. Flossie Hopson Anderson
8. Geoff Carrol, NSB, Department of Wildlife Management
9. *Joash Tuckle
10. *Daniel Leavitt
11. Arnold Brower, Jr., Chairman, AEWC
12. Doris Maupin

Kaktovik Public Hearing

(*Speaker Testified in Inupiaq--Translator, Emily Wilson)

1. James Savok, Jr., NSB, Planning Department
2. Loren Ahlers, Mayor, Kaktovik
3. Susie Akootchook
4. *Jonas Ningeok
5. Archie Brower
6. *Herman Rexford

Nuiqsut Public Hearing

(*Speaker Testified in Inupiaq--Translator, Emily Wilson)

1. James Savok, Jr., NSB, Planning Department
2. Maggie Kowalski, Mayor, Nuiqsut
3. Mark Ahmakak
4. Billy Oyagak
5. Nelson Ahvakana
6. *Teresa Hopson
7. *Patsy Tukle

Wainwright Public Hearing

(*Speaker Testified in Inupiaq--Translator, Mabel Panigeo)

1. Jacob Kagak, Mayor, Wainwright
2. Alma Bodfish
3. *David Panik
4. Charlie Brower, NSB, Department of Wildlife Management
5. James Savok, Jr., NSB, Planning Department
6. *David Kagak
7. Billy Patkotak
8. Johnny Adams
9. Lydia Agnasagga
10. Roberta Smith, NSB, Planning Department

Anchorage Public Hearing (December 17, 1986)--Excerpts

1. Cindy Lowry, Alaska Field Representative for Greenpeace.

We find the Draft Environmental Impact Statement to be fundamentally inadequate. We are greatly disturbed that the description of environmental impacts on the Beaufort Sea and the resources dependent upon it were either omitted, marginally discussed, or grossly discounted. In addition, it was not demonstrated that technologies exist for the safe development of potential oil and gas reserves. Having thoroughly reviewed the Draft Environmental Impact Statement, we conclude that the minimal amount of oil resources that might be gained from this lease sale simply do not warrant the risk of destroying this highly sensitive marine ecosystem. A-1 A-2 A-3

Furthermore, we request that stronger stipulations than those discussed in the Draft Environmental Impact Statement be imposed. At the very least, Sale 97 stipulations should require the same level of protection as those listed in the Sale 87 Notice of Sale. A-4

As stated above, we do not feel that the potential oil and gas reserves speculated for this sale are worth the potential environmental risks. The Draft Environmental Impact Statement points out that the risk of developing this small, potential reserve would include a 65-percent chance that the area would be exposed to one or more spills over 100,000 barrels, which would oil-contaminate at least 90 kilometers of shoreline. In addition, there would be over [a] 99-percent chance of one or more spills over 1,000 barrels. The Draft Environmental Impact Statement estimates the probability of 24.4 of these spills averaging 7,700 barrels per spill. A-5

The concept that the technology exists to deal with any spill that arises is a myth. According to the Office of Technology Assessment, it has not been demonstrated that industry will be able to use effectively the existing oil-spill equipment and strategies in hostile environments. Oil-spill-cleanup technology has been developed for spills in nearshore and temperate regions. It may not be suitable for use under the extreme conditions of the Arctic. Arctic oil-spill countermeasures will be complicated by extremely cold temperatures, the presence of ice, long periods of darkness, intense storms, and lack of transportation and storage facilities. A-6

What is known and what remains uncertain both point to an inevitable decline and possible annihilation of the subsistence lives of the Inupiat. Their great understanding of man's relationship with nature is an invaluable asset to global ecological survival that must not be snuffed out in the quest for minimal short-term benefits. A-7

The area at highest risk of being contacted by an oil spill from activities associated with the proposal is this spring lead system, which is a highly restricted and limited habitat. If an oil spill or noise and disturbances would affect whales in the lead system, there are no alternative routes by which whales could escape the inherent impacts. A-8 A-9

Given the extremely high value of the area, the high risk of impacting this area posed by the proposal, and the small potential oil and gas resources contained within the area, only 30 million barrels, we recommend that the Point Barrow Deferral Area be removed from the proposed lease sale. A-10

The next area is Kaktovik. Although this is not emphasized in the Draft Environmental Impact Statement, the waters contained in the Kaktovik Deferral Area are also recognized as serving high concentrations of feeding and migrating endangered bowhead whales. It would be inexcusable to expose a significant portion of the entire bowhead whale population and critical bowhead feeding habitat to the unknown potential impacts of oil spills, noise, and disturbance associated with developing this area. Again, projections for oil and gas reserves are quite small, only 90 million barrels, and we request that Kaktovik be removed from the proposed lease sale. A-11

The next area is the Chukchi Sea. Virtually no information which is directly derived from studies in the Chukchi Sea Deferral Area is presented for discussion. Almost all of the brief discussion concerning this area is done by extrapolating information from areas in the Beaufort Sea which may or may not actually be similar environments. Given that the bowhead whale and other undiscussed resources may be at risk which are not currently evaluated in the Draft Environmental Impact Statement and that this area is predicted to contain minimal resources, only 30 million barrels, this area should be removed from the proposed lease sale. A-12

As stated above, the Draft Environmental Impact Statement is generally vague and uninformative in its description of environmental impacts to the resources found in the lease-sale area. The most glaring example of this is the omission in the Draft Environmental Impact Statement of the biological opinion prepared by the National Marine Fisheries pursuant to Section 7 of the Endangered Species Act concerning the effects of OCS oil and gas leasing and exploration activities associated with the proposed sale. The question of whether or not the proposed lease sale would jeopardize the endangered bowhead whale is perhaps the most important issue of public interest from both a biological and cultural view point which needs to be addressed by the Draft Environmental Impact Statement.

A previous biological opinion prepared for Sale 87, which involves the same area as Sale 97, stated that an oil spill during migration was likely to jeopardize the continued existence of bowhead whales. Consultation for the Sale 97 biological opinion began most recently on July 17, 1985, although NOAA received an opinion from the Alaska Regional Office of National Marine Fisheries Service as early as 2 years ago. It is totally unacceptable that the opinion "might" be available for the FEIS as stated in Appendix J. There is simply no reason why the public should be denied the opportunity to review this opinion within the Draft Environmental Impact Statement. A-13

We demand that the DOI either extend the comment period until the biological opinion is included for public review or offer another comment period after the biological opinion is made public to ensure that public participation is not denied in evaluating the proposed sale.

Discussion of potential impacts to the populations of bowhead, gray, and beluga whales within the Draft Environmental Impact Statement is extremely lacking, inconsistent, highly speculative, and tends to discount negative impacts. Listings in the Draft Environmental Impact Statement with respect to cumulative impacts of OCS activities as minor or moderate regarding these whales is not acceptable, especially in the case of the endangered species. We will continue in our efforts to demand the protection of these endangered species and their habitat throughout their range, including proposed OCS lease-sale areas. A-14

Again, the minimal amount of oil resources that might be recovered from this lease-sale area simply do not warrant the risk of destroying this highly sensitive marine ecosystem. The technology for safe development and for spill containment and cleanup in the Arctic and deep water just does not exist. A-15

Adequate baseline studies should be complete before leasing so that it would be possible to monitor the effects of oil and gas development. A-16

2. Ginny DeVries, Staff Representative for the Alaska Wildlife Alliance.

The DEIS does not contain a biological opinion prepared by the National Marine Fisheries Service pursuant to Section 7 of the Endangered Species Act concerning the effects of OCS oil and gas leasing and exploration activities associated with the proposed sale. Without this information, there is no way to measure whether the endangered bowhead and gray whales would be jeopardized. The Department of the Interior's failure to present this information deprives the public of their right to evaluate and comment on this environmentally critical issue. A-17

A biological opinion, presented for Sale 87 involving the same area, found that the bowhead whale could be jeopardized by oil and gas exploration and development. No biological opinion is available for the bowhead whale in the Draft Environmental Impact Statement.

The DEIS lists the impacts of proposed development activities for the endangered gray whale as moderate. The definition of moderate for endangered or threatened species is when "a portion of a regional population declines in abundance and/or distribution in more than one breeding cycle, but recovery requires less than one generation." Since there is little specific information on other wildlife populations that would be affected such as polar bears, seals, and walrus, we feel the comment period needs to be extended until such information is provided. A-18

3. Sue Libenson, Alaska Friends of the Earth.

We were quite disappointed to find as we reviewed the Draft Environmental Impact Statement that important, available information was not included in this public document. Foremost is the unexplained absence of the biological opinion required under Section 7 of the Endangered Species Act concerning the bowhead whale. A-19

The bowhead whale is both a severely endangered species and central focus of the Inupiat culture. Impacts which are likely to occur to this species as results of activities associated with this proposed sale are without question one of the most important issues to be considered when evaluating the advisability of this sale. Section 7 of the Endangered Species Act was designed to ensure that the public would be well informed on any activity which might affect endangered species. Although no explanation is given as to why the biological opinion is omitted from the DEIS, its omission deprives the public, especially those whose lives are closely tied to the existence of the bowhead whale, from being fully able to comment on the proposed sale.

Knowing that consultation on this matter began as early as 2 years ago, that the Alaska Regional Office of the National Marine Fisheries Service submitted an opinion to Washington, D.C., and that a biological opinion was issued with due time for public comment for Sale 87, which involved the same waters as the proposed sale, we consider this omission to be negligent.

We demand that the comment period for the DEIS be extended until or reopened when the biological opinion is included for public review. It would be unacceptable to include the biological opinion in the Final Environmental Impact Statement as the public is being denied the right to comment on this important information at this earlier stage of the public process.

The Section 810 analysis is another requirement which is central to evaluating potential impacts to subsistence resources. The inclusion of this analysis has been upheld by court decisions regardless of the Department of the Interior's conflicting interpretation of the law. While this analysis is included in the DEIS, we find fault with the conclusion that the requirements outlined in Section 810 of ANILCA are met by the proposed sale as outlined in the DEIS. These requirements are that the sale be in the national interest, use the minimal amount of public land, and mitigate impacts to subsistence. A-20

The potential, estimated recoverable reserves in the proposed sale area are estimated at only 650 million barrels of oil. With current rates of national consumption at about 16 million barrels per day, if these reserves were actually present and produced, they would only account for about 40 days of oil. Yet, potential impacts associated with exploration and development could wipe out the livelihoods of the Inupiat people who depend on the resources of the Beaufort Sea. Endangering the livelihoods of thousand of Americans for the potential discovery of 40 days worth of oil is not in the national interest. A-21

The DEIS finds that the minimal amount of public land possible is used since only small areas of the proposed sale area are ever expected to be developed. This reasoning is misleading since any area proposed for sale will be potentially subject to impacts from exploratory activities so that the entire sale area is actually subject to impacts. A-22

Contrary to trying to mitigate impacts to subsistence, the department's proposed sale decreases mitigation requirements that have been included in past sales in the area. With no explanation, Stipulations and Information to Lessees, which serve as binding and advisory efforts to mitigate impacts to biological resources, have either been eliminated or weakened from the A-23 proposed sale's lease agreement when compared to the agreements developed for Sale 87. This is easily seen when you compare this sale agreement proposed in this Draft Environmental Impact Statement with the past agreement developed for Sale 87. If the Department were sincere in abiding by the spirit of Section 810, the proposed sale's requirements would, at a minimum, match the requirements outlined in past sales.

4. Mike Matz, Associate Field Representative of the Sierra Club.

The lack of important biological information is best exemplified by the omission of a biological opinion on bowhead whales rendered by the National Marine Fisheries Service as required by the Endangered Species Act. It is totally unacceptable that an opinion of probable impact to the bowhead whale population is not included in this document for public review. That the biological opinion "might" become available for the Final EIS in no way diminishes the inappropriateness of the omission. This leads one to question whether the Minerals Management Service is trying to shield something significant from the public. It also opens the door to a legal challenge of the EIS. A-24

We recommend that the Minerals Management Service prepare a supplement to the EIS containing the biological opinion as required by law, extend the public comment period, and conduct additional public hearings after the supplemental becomes available for public review.

Other discussion concerning possible impacts to biological resources sadly lacks specificity in the Draft EIS. Instead, generalities extrapolated from other areas of the Outer Continental Shelf are reviewed. Aside from the endangered bowhead whale, this area is important to marine habitat for the gray whale, beluga whale, ringed seal, bearded seal, walrus, polar bear, a variety of birds, and micro-organisms critical to the food chain for the larger species. Information specific to this offshore area on these species is cursory in most instances, and omitted entirely in other instances. Many questions are left unanswered. A-25

Despite these uncertainties and with little or no justification, the Minerals Management Service has relaxed several lease stipulations designed to mitigate adverse impacts. These stipulations have been changed from past lease offerings in this area. This leads to our second objection to Sale 97, the scant consideration given to Native peoples' subsistence lifestyles.

Many of these lease stipulations are designed to protect the marine biota from the adverse effects of oil exploration and development. It is a fact that these industrial activities impinge upon the ability of Natives to hunt for their subsistence needs. Relaxing the stipulations unnecessarily jeopardizes this way of life. We therefore urge the MMS not to change, but to restore Stipulations 4, 5, and 6, and Information to Lessees 1, 2, and 7, to the same status as outlined in Lease Sale 87. A-26

Furthermore, the three alternatives which contain either the Point Barrow, Kaktovik, or Chukchi Sea deferrals are nothing more than empty gestures. Oil development of extremely marginal reserves, only 30 million barrels in both the Chukchi Sea and Point Barrow areas, and 90 million barrels in the Kaktovik tract, would result in restriction and degradation of opportunities for A-27

subsistence hunters through contamination, disturbance, or development in whale migratory paths or feeding areas. Because of the deferral areas' proximity to traditional hunting areas, and their importance as habitat for subsistence resources, none of these three areas should be included in Sale 97 as part of any alternative.

The majority of the lease sale covers areas for which no safe and appropriate petroleum-extraction technology exists. Over 75 percent of the area is deeper than 40 meters, with some areas up to 1,000 meters in depth. The predominate [predominant] method of extraction now in use in the Beaufort Sea is the construction of causeways and artificial islands, a method only feasible in waters up to 20 meters deep. A-28

Bottom-founded mobile units can be used in depths of up to 30 meters, but have not been used in the ice-choked Beaufort Sea in Alaska. Floating drillships can be used in depths of up to only 300 meters, though this method has never been used in any Alaska OCS area. Inherent risks of serious environmental damage are compounded when untried methods are used for oil extraction.

5. William W. Hopkins, Executive Director, Alaska Oil and Gas Association.

Tract-deferral Alternatives IV, V, and VI are not justified by the MMS analysis in the DEIS, which concludes that there is no significant change in potential adverse impact by deferrals. Although resource estimates have been made in the DEIS, deferral areas could contain significantly greater resources than that. Only the drilling of exploratory wells will determine if oil is indeed present. A-29

As to a seasonal drilling limitation during times when bowhead whales may be present, AOGA submits that limitations such as Stipulation 4 are not necessary because the chance of any significant oil spill occurring is extremely remote. Over 6,000 exploratory oil and gas wells have been drilled in the U.S. OCS without a blowout which resulted in a major oil spill. A-30

Since 1956, over 28,000 exploratory and development wells have been drilled in the waters adjacent to the United States. Only one development-well blowout in the U.S. waters, the one that occurred in the Santa Barbara Channel in 1969, resulted in significant amounts of oil reaching our shores. Petroleum operations in the Beaufort Sea have resulted in no significant impacts. A-31

Further, industry has developed and demonstrated the ability to respond adequately to oil spills that may occur in broken-ice conditions. This ability has been the subject of extensive analysis, including demonstrations of cleanup capability in broken ice. A-32

Not only is it extremely unlikely that an oil spill would occur which would expose whales to a significant amount of oil, the scientific evidence now available shows that the oil's effect on the bowhead whale is generally overstated. A-33

Along with our written comments on the DEIS, we will be submitting for the record copies of two reports prepared by Doctors Geraci and D. J. St. Aubin. These reports include review of data which show the potential effect of oil on the bowhead whales. The scientific data available today, along with 2 years A-34 of field experience, clearly show that exploratory drilling in the Beaufort Sea is not a threat to the bowhead whale species. We trust that this information and other current data will be thoroughly considered in the preparation of the biological opinion on Sale 97.

Further, with regard to the question of the effects of OCS exploratory activity on subsistence hunting of whales, we would like to point out that in 1986 the villages of Kaktovik and Nuiqsut were successful in obtaining four whales out of their total limit of five. These kills were made during a period when marine seismic and exploratory drilling activities were being carried out in the immediate vicinity of the hunting area, which was in the eastern portion of the proposed sale area. The fact that the subsistence hunt, seismic operations, and drilling operations during this past season all came to a successful conclusion simultaneously offers evidence that exclusion of drilling and seismic activity is not necessary to preserve subsistence activities. A-35

6. Bill Oppen, Director of Policy Planning and Intergovernmental Relations, Government of Yukon.

We must also advise that the Yukon Government does not accept that lands east of the 141st meridian be included within this sale. While consideration of the transboundary impacts is appropriate, the designation of lands for lease east of the 141st meridian for sale is not.

As you are aware, and as the authors of this assessment have carefully pointed out on the inside cover of this document, the offshore boundary between Canada and the United States remains the subject of a dispute. The Canadian Government has objected by way of a formal note of protest to the U.S. Government.

The actions taken to include these lands in the lease sale have elicited significant controversy in Canada as a whole. Despite the disclaimers offered by the authors of the report, we feel that the inclusion of the disputed lands may have implications that extend beyond the waters of the Beaufort Sea. A-36

While the Yukon Government respects the right of the U.S. Government to state and pursue its claim, we do not feel that any leases should be granted until such time as our two countries have resolved their differences on the boundary issue.

We see no reference within this document to the impacts the Yukon coastline and Herschel Island might face as a result of an oil spill occurring on leases located on or across the border. Such a spill could have long-term effects upon our coastal environment and upon Canadian wildlife habitat important to both countries. A-37

With respect to caribou, we are concerned with the report's apparent minimization of potential impacts and the failure to consider the extensive use made of the Porcupine caribou herd by the Native people of the Yukon and the western Northwest Territories. A-38

Further, adequate attention has not been given to the relationship between the 20-02 [10-02] lands proposal and the effect it could have on the onshore support facilities that may be required for the Sale 97 lands. In our opinion, the longer-term cumulative effects on Porcupine caribou habitat must be reviewed in more detail. A-39

As you may be aware, our two countries have initialled a draft International Porcupine Caribou Herd Management Agreement. We would strongly suggest that the terms of this agreement and its management implications be considered in the redraft of this assessment.

We have referred to the subsistence use of the Porcupine caribou herd by Yukon aboriginal people. None of the species discussed in this report care a great deal about the boundaries man has created. All of these species, from beluga whales to waterfowl, are shared by the people of Canada and the United States and form an important part of their culture. Many of these species are depended upon by aboriginal people for food. We do not feel that the proper attention has been given to the international use of these resources and the effects this proposal may have on that use. A-40

With respect to the consultative process involved in the preparation of this assessment, we are pleased to see that input from important groups like the Isaac Walton League of America and Greenpeace has been sought. We are disturbed, however, to find no reference to consultation with such groups or agencies as Canada's Department of Fisheries and Oceans; or the Department of the Environment; or Parks Canada, which established a national park in the northwest Yukon; or the Canadian Wildlife Service; or the governments of the Yukon or Northwest Territories. A-41

We similarly are puzzled to find no reference to consultation with the people of Old Crow or with the Committee for Original Peoples Entitlement, groups that depend to a great extent upon the resources affected by this proposal.

The Government of the Yukon asks that the agencies, organizations, and committees we have referred to be formally consulted prior to the preparation of the Final EIS.

Finally, we would respectfully submit that the Final EIS for Sale 97 lands not be prepared until hearings into the 10-02 lands proposal have concluded and the potential relationships between the two proposals have been clarified. This delay will also allow the time required for the international consultation we have spoken of to take place and will allow Canadian interests to be more fully developed. A-42

7. Randy Stilley, representing National Ocean Industries Association and Alaska Support Industry Alliance.

More than 32,000 wells have been drilled in State and Federal waters off the U.S. coast and there has been only one spill in which significant amounts of oil reached shore. Every day, in fact, some 1.2 million barrels of oil and 13.7 billion cubic feet of natural gas are being produced from offshore wells in an environmentally safe manner. Only a tiny fraction of oil in the world's A-43 oceans, about 5/100 of 1 percent of the total, is attributed by the Minerals Management Service to offshore operations under Federal supervision, including drilling, production, pipelines, and transportation to shore.

This is a record of environmentally clean, compatible operations which prompts us to question the proposed lease stipulation which would impose a seasonal drilling restriction to "protect endangered bowhead whales from the risk of oil spills during their spring and fall migrations." This stipulation would prohibit exploratory drilling, testing, and other downhole exploratory activities. We question the rationale for such a restrictive and costly stipulation and it's important to note our industry's environmentally safe operating record on the OCS.

8. Rob Dragnich, Engineering Coordinator, Exxon Company, USA.

Exxon strongly opposes Alternative 2, delay the sale, and the three deferral options. These deferrals are not justified on the basis of the MMS analysis, which indicates that there is a negligible difference in potential adverse impact between the preferred alternative and the deferral alternatives. Furthermore, it it quite possible that the deferral areas could contain significant commercial reserves, particularly if they are developed in conjunction with adjacent offshore or onshore deposits. A-44

First, the MMS schedules for exploration and development in this frontier area continue to be overly optimistic by at least 5 years with respect to platform installation and by at least 4 years with respect to first production. This overly optimistic development schedule leads to at least two erroneous assumptions. First, it projects potential impacts sooner than they might actually occur. Second, the schedule appears to shorten the amount of time available for planning and assessment.

Those interested in this sale should recognize the amount of time available for planning and assessment. Those interested in this sale should recognize that exploration and development of oil and gas in the Diapir Field will take a very long time. While the time estimates of individual companies may differ, it is generally agreed that it will take about 13 years from the time of the lease sale until first production. A-45

The elements which contribute to this long exploration-to-production timeframe include: The geological complexity of the area; the severity of the environmental conditions; and the sequential procedures for acquiring geophysical data, drilling, testing, and analyzing each well.

The extremely high cost of development is perhaps the single most important factor in determining the schedule of activities. Because of this high cost, it will take considerable time to discover, delineate, and characterize reserves that are large enough to justify these enormous capital investments.

Predrilling surveys and permit acquisitions will take at least a year, and the actual exploration phase could take from 3 years to more than 10 years in order to acquire the necessary data to make a field development investment decision, an investment which is likely to run into the billions of dollars.

Once a decision has been made to develop, it is necessary to conduct scoping studies and conceptual engineering; to prepare detailed development plans, appropriate environmental reports, and an EIS; and, finally, obtain all necessary permits. This entire process normally take 3 to 4 years.

Major commitments for the purchase of the equipment for development normally are not made until all major permits are in hand. Construction of facilities, including the support and staging areas and the hydrocarbon transportation system, in addition to development drilling, will add another 6 years to the timetable. Thus, this high-level activity, which has the greatest potential for impact, would not occur until about 1995, nearly 7 years after the lease sale.

Since this schedule is longer than that used for Alternative I impact assessment, the highest potential for impacts will arise later than described. The foregoing timing of activities provides ample opportunity for State and local planning.

My second point is that we believe many of the proposed lease stipulations identified in the DEIS are unnecessarily restrictive, pre-emptive, and burdensome on operations conducted on the sale tracts. We recommend that any lease stipulation and/or mitigating measure imposed upon lessees be drafted with sufficient flexibility so that its application can be considered on a case-by-case basis and in the context of site-specific conditions. This would be consistent with the MMS policy of adopting performance standards in its revision of the regulations governing all OCS oil and gas operations. Performance standards would provide the appropriate flexibility for future modification or deletion of a lease requirement as information or advances in technology indicate that such requirement is unnecessary. A-46

In assessing potential environmental and socioeconomic impacts resulting from potential hydrocarbon development, it is important to emphasize that permit requirements and other regulatory measures currently in effect are designed to prevent or mitigate potential adverse impacts. Many governmental agencies already exert regulatory and enforcement authority over OCS operations. Exxon is ever-conscious of the importance of compliance with the intent and the letter of current regulations in planning and conducting exploration and development activities.

A particularly onerous lease stipulation is the imposition of a seasonal drilling restriction. Exxon opposes this restriction based on our demonstrated ability to operate in a safe and environmentally acceptable manner in the Beaufort Sea. A seasonal drilling restriction results in increased costs to the operator and ultimately to the consumer. These costs are disproportionate to presumed benefits. A-47

The apparent rationale for imposing such a restriction is the concern about possible oil spills. The public should be made aware that oil spills resulting from an exploratory-well-control problem are not likely to occur. As you probably know, a major oil spill has never occurred as a result of exploratory drilling in the U.S. OCS.

9. Barbara Johnson, National Audubon Society.

After reviewing the DEIS, we cannot support the lease sale as proposed. The minimal economic benefits to be derived are simply not worth the risk to coastal living marine resources. Proposing yet another major oil and gas lease sale in the Beaufort Sea at this time is not in the public interest. This is particularly true since a majority of the tracts leased in the Beaufort Sea Sale just 2 years ago have not yet been explored. A-48 A-49

In addition, it does not appear that the Federal Government received a fair return on the last lease sale conducted. In fact, I've got a copy of this Federal Offshore Statistics 1984 Report that just came out and it shows that of the three lease sales conducted in the Beaufort Sea to date, the average bid per acre for the August 1984 sale dropped dramatically from the two earlier sales.

In fact, the average bid per acre for the first two Beaufort Sea sales was $2,688 in comparison to the 1984 sale, which only brought an average bid per acre of $708, which is quite a difference. A-50

By flooding the market with large offerings, the Federal Government is not getting a fair-market value for those tracts. It is irresponsible management of public OCS lands to conduct yet another sale in this area at a time when there is currently a world oil glut and when serious questions are being raised about the impacts of such a sale and what effects the sale could have on [the] Arctic marine environment and the Native subsistence lifestyles of the region.

We're also disturbed to find that the DEIS does not include a Biological Opinion from the National Marine Fisheries Service with regard to effect of Sale 97 on bowhead whales, pursuant to Section 7 of the Endangered Species Act.

As you know, protection of critical habitat for the endangered bowhead whale is of particular concern in the Beaufort Sea. The great importance of this whale species to Alaska subsistence users as well as national and international conservation interests is well documented. A-51

Much remains to be learned regarding offshore water and ice movements and effects of offshore oil and gas exploration and development on bowhead whales. Why is it, then, that the best information on the effects on Sale 97 from a management agency with jurisdiction over bowhead whales is not included in the DEIS? How could the general public make a recommendation on a sale when such vital information is not available?

In addition to bowhead whales, there's limited information available to accurately measure impacts on marine birds and marine mammals including polar bears; walrus; spotted, ringed, and bearded seals; and gray and beluga whales. We also question the ability of the leaseholders to adequately protect these living marine resources, given the harsh environment of the area and the fact that exploratory drilling technologies and procedures that have not been used previously in the Alaska Beaufort Sea are being proposed in deep-water packed-ice zones. A-52

11

10. Dave Yesland, Manager, Regulatory Affairs, Shell Western E & P, Inc.

I wish to comment on the success of coincidental oil and gas exploratory operations and subsistence whale hunting in 1986. During September and October of 1986, both marine seismic and exploratory drilling activities from drillships were carried out successfully in the immediate vicinity of the whale hunting areas in the eastern portion of the proposed lease area.

While these activities were taking place, the hunters of Kaktovik and Nuiqsut were able to take and recover four bowhead whales, 80 percent of their quota. These results tend to support the thesis that exploratory oil and gas activities will not have a deleterious effect on subsistence hunting of the bowhead whales. A-53

A factor that very likely had an effect in the coincidental success of both activities was the 1986 oil/whalers working group, which was formed independent of any governmental involvement by the oil and gas operators and the Inupiat whalers. This group provided the preliminary communication between the two interests which led to an operational program of field communications and coordination designed to avoid conflicts in the mutual use of the Beaufort Sea. This program also facilitated emergency assistance to the whalers and on two occasions in 1986 assisted in life-threatening situations. I have submitted a copy of the cooperative programs for the Beaufort Sea Manual, which served as a guideline for the 1986 oil/whaler program, to the hearing officer with copies of my comments.

11. Mike Abbott, Resource Development Council for Alaska.

We'd also like to state at this point that it is important that any activity in the Beaufort Sea, any allowed activity, leasing, exploration, development, production, et cetera, needs to be regarded in the appropriate regulatory condition. Development under any circumstances could, perhaps, lead to no development at all and if it is, in fact, the policy of the Minerals Management Service to foster that development through a leasing plan, we would encourage you to make sure that the conditions, stipulations, and all other facets of your regulatory authority and that of the rest of the government is conditioned on the fact that you do, indeed, support that development and that you'll want to be reasonable in terms of your regulatory authority. A-54

We think that it's important to recognize that many of the regulations, stipulations, and conditions which we've all discussed in various forms could have significant cost impact in terms of the impact on development and the timelines for that development with relatively marginal gain in environmental quality, environmental protection, et cetera. A-55

We'd like to point out that there has been significant activity all across the Arctic Ocean, generally in terms of the Beaufort Sea as it stretches across Alaska and into Canada, in terms of OCS activity, drilling, and exploration of all types and potential production in the near future. A-56

We'd certainly like to see the Minerals Management Service examine the full range of environmental conditioning and environmental regulatory activity that's taking place across there and take advantage of the expertise and the experience that's been gained as those activities have taken place.

12

Response A-1

Without examples, MMS is unable to make specific responses regarding alleged missions, marginal discussions, or gross discounting of the environmental ffects. The selection of the biological resources, social systems, and hysical regimes of the Beaufort Sea, northeastern Chukchi Sea, and the adjacent coastal area of northern Alaska analyzed with regard to the effects of proposed Sale 97 was based on major scoping issues, Table I.D.1; the process of determining the major issues is briefly described in Section I.A.5--Scoping. Furthermore, the Sale 87 FEIS analyzed the potential effects n the environment from possible petroleum-exploitation activities in a roposed lease area covering approximately 17.2 million acres. (The proposed ale 97 study area covers about 21.2 million acres.) Sale 87 was the third CS oil and gas lease sale in the Beaufort Sea Planning Area. The analyses in oth the Sale 87 and Sale 97 EIS's are based on available scientific and ociocultural information as well as the hypothetical exploration and development and production scenarios. These scenarios are based on (1) estimated petroleum resources, (2) estimated levels of activities and schedules of events, and (3) assumed locations of petroleum-related facilities. Also, see Response 2-1.

Response A-2

The technologies that have been and may be used to exploit the petroleum resources of the Sale 97 area are discussed in Section III.A.3.

Response A-3

This concern is addressed in Response 21-68.

Response A-4

This concern is addressed in Response 21-12.

Response A-5

This concern is addressed in Response 21-2.

Response A-6

Technology does exist for oil-spill response in the Beaufort Sea, but its effectiveness is limited. This point is discussed in Section IV.A.2.

Response A-7

This concern is addressed in Response 8-23.

Response A-8

This concern is addressed in Response 21-5.

Response A-9

Under some circumstances, whales may be prevented from moving through a lead system for a period of time. However, the spring lead system is very dynamic.

Leads open and close, and new leads may form in areas far enough away from an oil spill or noise disturbance to allow bowheads to pass undisturbed. Also, bowheads have been observed breaking and respiring through ice (Krogman et al., 1986), so if the ice is relatively thin or weakened--a typical spring condition--bowheads could avoid the affected area by migrating under the ice. Also, see Responses 7-10 and 7-14.

Response A-10

This concern is addressed in Response 12-1.

Response A-11

This concern is addressed in Response 21-9.

Response A-12

These concerns are addressed in Responses 12-1 and 21-11.

Response A-13

This concern is addressed in Response 7-13.

Response A-14

The MMS has assessed as accurately as possible the potential effects of OCS oil and gas exploration and development on marine mammals and endangered species; this analysis has been based on currently accepted scientific literature. The MMS will continue to meet its obligations in regard to the protection of species under the Marine Mammal Protection Act and the Endangered Species Act of 1973, as amended.

Information cited in the 97 EIS on the effects on beluga whales of oil spills, disturbance, and habitat alterations that may be associated with the proposal (for example, see Geraci and St. Aubin, 1982, and Aubrey et al., 1984) indicates or at least strongly suggests that the effects of the proposal would be NEGLIGIBLE or no more than MINOR. The analysis of the effects of the proposal on beluga whales as well as pinnipeds and polar bears in Section IV.B.4 indicates that the overall effect on the beluga whale population occurring in the Sale 97 area is likely to be MINOR.

Also, see Response 21-23.

Response A-15

These concerns are addressed in Responses 12-1, 21-45, and 21-46.

Response A-16

MMS believes that its monitoring studies program will be adequate to monitor the potential effects of future petroleum development and production.

Also, see Responses 6-2 and 6-3.

Response A-17

This concern is addressed in Response 7-13.

Response A-18

As noted in Section IV.B.4, adequate information is available to analyze the effects of petroleum exploitation on polar bears, seals, and walruses.

Response A-19

This concern is addressed in Response 7-13.

Response A-20

This concern is addressed in Section I.B.3.e.

Response A-21

These concerns are addressed in Responses 21-1 and 21-68.

Response A-22

This concern is addressed in Section I.B.3.e.

Response A-23

These concerns are addressed in Responses 8-23 and 21-12.

Response A-24

This concern is addressed in Response 7-13.

Response A-25

This concern is addressed in Responses 21-21 and 21-23.

Response A-26

The concerns regarding differences between specific mitigating measures for Sales 87 and 97 are addressed as follows:

(1) Stipulation No.4--Seasonal Drilling Restriction, see Response 21-13;

(2) Stipulation No.5--Transporation of Hydrocarbons, see Response 21-14;

(3) Stipulation No. 6 (Sale 97 NOS)--Oil-Spill-Cleanup Capability, see Response 21-15;

(4) ITL No.1--Information on Bird and Marine Mammal Protection, see Responses 21-16 and 21-12;

(5) ITL No.2--Information on Areas of Special Biological and Cultural Sensitivity, see Response 21-18;

(6) ITL No.7--Information on Endangered Whales, see Response 21-19.

Response A-27

This concern is addressed in Responses 12-1, 2-1, and 8-23.

Response A-28

This concern is addressed in Responses 21-45 and 21-46.

Response A-29

This concern is addressed in Responses 2-1 and 12-1.

Response A-30

This concern is addressed in Response 10-1.

Response A-31

The commenter's statistics for past spillage are consistent with those presented in the FIS. Few spills occur, and few of those that do occur contact land. Most effects from petroleum operations are anticipated to occur during production. No oil production has yet occurred in the U.S. Beaufort Sea.

Response A-32

This concern is addressed in Response 10-27.

Response A-33

This concern is addressed in Response 10-28.

Response A-34

The information in the two reports by Drs. J. R. Geraci and J. St. Aubin have been forwarded to NMFS, the agency responsible for preparing the biological opinion on the bowhead whale species.

Also, the text in Section IV.B.9.a(2)(a) has been revised to include statements regarding (1) the cooperative programs between the oil industry and the AEWC, NSB, and Kaktovik and Nuiqsut whaling captains and (2) the results of the 1986 fall bowhead whale hunt in the eastern Beaufort Sea.

Response A-35

The text in Section IV.B.9.a(2)(a) has been revised to address this concern.

Response A-36

Section I.B. has been amended to include a discussion of the jurisdictional controversy between the United States and Canada.

Response A-37

The oil-spill-risk analysis does consider the possibility of oil contacting the Canadian shoreline, including the MacKenzie River Delta (see Fig. IV-1), taking into account spill risk from both U.S. and Canadian oil development. However, the analysis indicates that neither the proposal nor the cumulative case (including offshore Canadian development) pose significant likelihood of contact to Canadian shoreline (Sec. IV.A.2.b).

Although no specific analysis has been done for areas in Canada, effects for many of the Alaskan biota should be directly translatable to Canadian organisms if, for example, they were contacted by an oil spill. Political boundaries do not coincide with the boundaries of animal and plant populations, and a number of species considered in the EIS are international in the sense that their migrations do not stop at the U.S.-Canadian border. Issues and species (marine mammals and fishes) of mutual concern have been identified by U.S. and Canadian scientists (workshop at Banff, Alberta, in Dec. 1986), with plans to continue to explore and investigate these issues.

Effects on international wildlife populations such as snow geese and caribou shared by Canada and the U.S. are discussed in the cumulative-effects sections in Section IV.B.3.b(1) for marine and coastal birds and Section IV.B.6.b for caribou.

Response A-38

The continued presence and increased abundance of Central Arctic herd caribou in association with oil development on this herd's summer range and calving range suggest that other caribou herds such as the Porcupine caribou herd will not be seriously affected by oil development on the Arctic coastal plain. Effects on caribou distribution in the Prudhoe Bay area and disturbance-harrassment of caribou by motor-vehicle traffic could be greatly reduced on the ANWR by enforcement of seasonal restrictions on industrial activities during the calving season; Congress must enact legislation to authorize an oil and gas leasing program for ANWR. The FWS is legally mandated to protect the Porcupine caribou herd and other species populations such as snow geese. The U.S. and Canada initialed a draft agreement on the conservation of the Porcupine caribou herd in December 1986; Section IV.B.6.b.(5). This agreement would assist in cooperative conservation of the herd.

Response A-39

The cumulative-effects section on caribou, Section IV.B.6.b, has been expanded to include a more detailed and thorough analysis of various projects and potential effects to which the caribou herds could be exposed on the Arctic coastal plain.

Response A-40

We agree that the subsistence resources in the Sale 97 area are of concern in the Canadian Beaufort area as well. However, in the subsistence analysis, many of the subsistence-harvest effects--noise, disturbance, construction activities, and location of facilities--would be too distant from subsistence harvests in the Canadian Beaufort to affect their subsistence harvests. An

oil spill is the only causal agent that could result in some effect, and this subject has been addressed (see Sec. IV.B.9.a[3][e]). It should also be noted that marine mammals also migrate through the Bering and Chukchi Seas. No less attention was given to the Canadian Beaufort than to Alaskan areas outside of Sale 97 area. It is a matter of being too distant from the affected area or the effects not being large enough to affect the populations of the subsistence resources.

Response A-41

Although the Alaska OCS Region did not consult with agencies of the Canadian Federal and Yukon Territorial Governments during scoping, MMS staff members are in contact with Canadian researchers studying the potential effects of petroleum exploitation in the Arctic regions of North America. These contacts are noted in Response A-56 and help provide MMS with the information necessary to analyze the potential effects of Sale 97 along the North Slope of Alaska and in the Alaskan Beaufort Sea as well as in the Canadian Beaufort Sea and the adjacent coastal areas.

The Alaska OCS Region is not aware of any comments from Canada in response to publishing the Call for Information and Nominations and Notice of Intent to Prepare an Environmental Impact Statement in the Federal Register on September 24, 1984 (49 FR 37532), which invited comments on areas of interest or special concern in the proposed lease-sale area; see Section I.A.3.

Response A-42

As noted in Table IV-A-7 and Appendix B of the Sale 97 FEIS, petroleum exploration and development and production in ANWR is one of many ongoing and future projects considered in the analyses of the cumulative effects of mineral-resource exploitation on the biological resources, social systems, and physical regimes of the Beaufort and Chukchi Seas and adjacent coastal areas.

Future actions regarding Sale 97 and the Section 1002 lands are dependent, in part, upon the legal mandates of two statutes; the Outer Continental Shelf Lands Act (OCSLA) of 1953, as amended, for Sale 97 and the Alaska National Interest Lands Conservation Act (ANILCA) for the 1002 lands. The OCSLA charges the Secretary of the Interior with (1) administering the minerals exploration and development and production on the U.S. OCS and (2) preparing and maintaining a 5-year OCS oil and gas leasing program. Sale 97 is one of 16 sales scheduled for offshore Alaska under the current 5-year OCS oil and gas lease schedule for the period August 1982 through June 1987. The Sale 97 FEIS is presently scheduled to be published in June 1987.

Section 1002 of ANILCA requires the Secretary of the Interior to (1) conduct a comprehensive, continuing baseline study of the fish and wildlife resources of the Arctic Refuge 1002 area (Arctic National Wildlife Coastal Plain); (2) develop guidelines for, initiate, and monitor an oil and gas exploration program; and (3) prepare a "Report to Congress" that describes the fish and wildlife resources of the 1002 area, identifies and estimates the volume and areal extent of potential hydrocarbon resources, assesses the potential effects of development, discusses transportation of oil and gas, discusses the national need for domestic sources of oil and gas, and recommends whether further exploration and development and production of oil and gas should be allowed. The "Report to Congress" was submitted in April 1987. The Congress must enact legislation to authorize an oil and gas leasing program for the Sale 1002 area.

Response A-43

This concern is addressed in Response 10-1.

Response A-44

This concern is addressed in Responses 2-1 and 12-1.

Response A-45

This concern is addressed in Response 10-8.

Response A-46

Stipulations are proposed to reduce or eliminate potential adverse effects associated with development and thus provide specific protection to meet important biological, cultural, and environmental concerns. Many provide flexibility on a case-by-case basis through the authority of the RSFO to invoke such measures as necessary to protect the environment or ensure human safety. Stipulations are also subjected to detailed analysis and review under the NEPA process as necessary to promote a balance between safe and orderly development of oil and gas resources and protection of the environment as required in the OCS Lands Act.

Response A-47

This concern is addressed in Response 10-1.

Response A-48

This concern is addressed in Response 21-68.

Response A-49

The MMS has predicted that 39 exploration and delineation wells would be drilled to explore for petroleum resources in the Sale 87 leased areas from 1986 through 1993. Leases resulting from Sale 87 have an initial term of 10 years; the sale date was in August 1984, and 227 leases issues were issued. The first exploration well in a Sale 87 leased block was drilled during August and September of 1985; to date, only 4 wells have been drilled in Sale 87 leased blocks. Thus, it is not anticipated that a majority of the well drilling associated with the exploration phase would be completed by the time of the Sale 97 sale date.

Response A-50

The primary reasons for the drop in the average bid per acre in the 1984 Beaufort Sea sale (Sale 87) were the locations of the leases (farther from Prudhoe Bay and farther from shore) and lower price forecasts. To ensure that accepted bids adequately reflect fair-market value, MMS assesses the adequacy

of the bids, and the Department of Justice may review them for compliance with antitrust laws; the fair-market value is determined for each sale. MMS is required by law to get the fair-market value for the leases.

Response A-51

This concern is addressed in Response 7-13.

Response A-52

This concern is addressed in Responses 21-21, 21-23, 21-45, and 21-46.

Response A-53

The text in Section IV.B.9.a(2)(a) has been revised to address this comment.

Response A-54

The MMS is charged with the responsibility for ensuring that the development of the offshore energy resources is conducted in a safe and orderly manner to prevent or minimize occurrences that may cause damage to the environment; thus, the agency does not support development *per se*.

The MMS endeavors to ensure the reasonableness of its regulations, orders, and lease stipulations through a review and comment process. When new or revised regulations and orders are proposed, they are published in the *Federal Register*, and the public has the opportunity to comment on them before they become final. Lease stipulations also are subject to the review and comment process. Proposed lease stipulations for an OCS oil and gas lease sale are published in the FEIS and then in the PNOS for that sale. The public therefore has several opportunities to comment on the stipulations before they are adopted or rejected.

Response A-55

The MMS recognizes that the laws, regulations, orders, and stipulations will affect the economics and scheduling of petroleum-exploitation activities. However, the operating costs of the petroleum companies is proprietary information; thus, the expenses associated with operating within the regulatory framework of the Beaufort Sea may not be available to the public.

MMS periodically reviews its regulations, orders, and stipulations and revises those that need to be updated because of advances in technologies or availability of significant new information; some of these revisions may reduce operating costs.

Response A-56

MMS is very much aware of the activities that are taking place across the Arctic. Among the indications of this awareness that are noted in the EIS are (1) references to articles written by foreign, especially Canadian, authors and (2) studies where MMS-funded research contractors have cooperated or coordinated their research efforts with Canadian investigators (App. D, Research Units [RU] 205, 606, 632, and 633). Canadian researchers have attended MMS-sponsored synthesis and information-transfer meetings and workshops; and MMS staff members regularly attend conferences on the physical and biological resources, social systems, environmental conditions, and technologies of the Arctic.

Barrow Public Hearing (December 8, 1986)--Excerpts

1. James Savok, Jr., NSB, Planning Department.

The North Slope Borough joins the Alaska Eskimo Whaling Commission in its support of deferral of both the Barrow area (Alternative IV) and the Kaktovik area (Alternative V) from the Lease Sale Number 97. The Borough's position could be viewed as advocating yet an additional alternative, Alternative VII, Barrow and Kaktovik Deferral. B-1

Any industrial activity within the Barrow Deferral Area during the bowhead whale spring migration will most certainly drastically affect the timing and space utilization of this normal migratory path by the bowhead whale. This would very probably adversely affect the overall population of the bowhead whales and would certainly result in a reduction of the availability of those animals to allow for a subsistence harvest adequate to meet the needs of the community. Moreover, an oil spill occurrence in this area during the spring migration or just prior to commencement of the spring migration would have a catastrophic effect on the survivability of the bowhead whales. B-2

The Kaktovik Deferral Area is an area used by the bowhead whales during their annual fall migration. The North Slope Borough and the Inupiat subsistence whalers have always known these waters to contain nutritionally rich biotic habitat of the bowhead whale. For this reason, it is felt that the more intense studies are required to identify and document the feeding habits of the bowhead whales in the eastern Beaufort Sea which would be crucial for protection against contamination by industrial activity. Studies to document the impacts of industrial noise upon the bowhead whale are scarce and more data is needed to facilitate reasoned decisions regarding the bowhead whale and industrial activities. Thus, the Borough recommends that the Kaktovik area be deferred for a period to allow for the completion of studies to develop a sound database. B-3

The Inupiat communities and the subsistence whalers have always recognized the acoustic sensitivity of the bowhead whale. The subsistence whalers have always used a commonsense mitigative approach regarding noise to obtain successful harvests. The Borough feels therefore that the Federal Government must recognize the sensitivity of both the Barrow Deferral Area and the Kaktovik Deferral Area by deferring any leasing activities in the Barrow Deferral Area for a period not less than 5 years and preferably for whatever period is required to complete needed research and deferring leasing activity in the Kaktovik Deferral Area for a period sufficient to complete current research. B-4

The North Slope Borough has no objection to the Chukchi Sea lease area. However, the Borough recommends that studies be made in this area regarding the biological content and the resources dependent upon the biota. The Borough is concerned that this area lacks a database which is needed to make reasoned decisions, in particular with regards to the subsistence resources and their habitat. The Borough also realizes that the main pack ice movements within the proposed lease area will pose new problems for industrial exploration and development. Therefore, it is recommended that studies of sea ice dynamics be conducted prior to any activity taking place. B-5

2. Charles D. N. Brower, NSB, Department of Wildlife Management.

In [my] mind, the Draft EIS does not adequately address or explain the possible effects this lease sale may have on our subsistence resources and the way of our life. Rather, these issues are avoided in almost all of the alternatives with a statement that the impacts or effects will be minimal. I don't think that is enough. What I would consider to be more acceptable is an explanation of what [effect] an oil spill, for example, would have on our marine wildlife and the animals that depend upon the marine environment for survival and how our subsistence hunting would be affected. B-6

Furthermore, I would see more problems arising and our hunting activities further restricted in developing any oil fields that might be discovered. For example, if a pipeline was to be built to carry the oil from the offshore area, it would certainly restrict the movement of fish and other marine wildlife. And if a pipeline is then to be built to transport the oil from Barrow to link up with the Trans-Alaska Pipeline, it would hamper the movement of caribou and other such wildlife. B-7

These pipelines would also cause additional restrictions on our hunting activities, I would imagine that, like, at Prudhoe Bay. We would either need special permits or even be restricted from traveling anywhere near any pipeline corridor. B-8

3. Ron Nalikak, Administrative Director, AEWC.

Some of the other concerns are as follows. On the eastern portion of the lease sale area, such as in the Kaktovik and the Nuiqsut areas and in the Barrow area to the west, all sites of activities would cease until such a time that the village quota or crucial. needs have been met during the annual fall whaling. B-9

Another concern of the Alaska Eskimo Whaling Commission and the whaling communities is the effect of noise due to offshore drilling and seismic activities. We feel that associated noise have lessened the fields used by the bowheads. No feeding grounds by Barrow, Kaktovik, and the Canadian border. B-10

The Alaska Eskimo Whaling Commission is also concerned that all industrial noise associated with offshore activities such as exploratory drilling, seismic, may interfere with the subsistence whaling activities during the spring and fall for the villages of Barrow and Wainwright and fall whaling for the villages of Nuiqsut and Kaktovik. B-11

Finally, the Alaska Eskimo Whaling Commission recommends to the Minerals Management Service that Stipulation #4 be strengthened and should also include that it should be in effect when the coastal villages are involved in the subsistence hunt of the bowhead whale, [and] that Stipulation #4 should also be expanded to protect the whales and also whaling during the construction phase of islands or subsea pipelines. B-12

4. Billy Adams, NSB, Department of Wildlife Management.

The latest information shows 87 percent of the dens out on the ice. Polar bears that den out there will not tolerate noise disturbance. Polar bears depend on their dens for safety and the cubs will not be able to survive in the Arctic climate if [when] the cubs are born. That is, if they are born. B-13

Another was oil ingestion or oil being ingested by polar bears. The effect it would have on the polar bears, that they will not be able to regulate their own body heat. This would mean their death by getting too cold. Polar bears will not be able to control body fluid. This is very serious. And bears that ingest oil also have kidney failure. This means death. B-14

Polar bears naturally lick their skin to be clean. Bears also swim very long distances and they are very curious animals. They will investigate an oil spill and by that way they can ingest oil. That will also mean death.

We need more studies on polar bears and more studies of many other life forms up there as to what would happen to our polar bears' food and our Native food. The Beaufort Sea is our farm. B-15

5. Tom Albert, NSB, Department of Wildlife Management.

I agree. . .that both the Barrow Deferral and the Kaktovik Deferral be combined into some sort of an alternative.

It seems unfortunate that the folks who are planning the document didn't offer that as a deferral because I think our comments made at the scoping process with regard to the bowhead--I think that was maybe an unfortunate accident, I'm sure. B-16

As I said, I would call your attention to Table II-C-1, which is a nice summary, and under it, [the] endangered and threatened species treatment, where it considers what happens in the Alternatives. It lists, as near as I can make out, the overall effect of the sale, for instance, on bowheads being minor in each one of the Alternatives and I guess maybe we can't ask any questions now, but I don't understand how that can be, how under all these Alternatives the effect can be minor.

What this may be saying to me is that the preparers feel that the Barrow and Kaktovik Deferrals are really not worth anything as far as the bowhead. I don't know what other explanation it could be. So, I think that is wrong. B-17

It seems to me that if there's ever a place in the whole system that we know about bowheads, that if you begin industrial development in the so-called Barrow Deferral Area and you feel that is going to have essentially no impact on the animals, then I don't think things were being added up properly because when the animals are in the ice there in the spring, I think that they would certainly be subject to more than a minor disturbance.

The feeding area over there in Barter Island and the Canadian border, if that's become industrialized, I think that that too is going to have more than a minor impact on these animals.

3

And if you just turn a couple more pages on that same table and go to the subsistence harvest patterns section, two pages later, again, it seems to say that impacts will be moderate all the way across the Alternatives. And, again, I don't understand that. If there is industrial activity in the Barrow area during the time when the whales migrate and people are hunting, I mean, that's got to have some kind of effect, and in the Kaktovik area also. B-18

So, those two areas are the areas where you're going to impact subsistence activities the most and if you remove them from the system, it's got to do some good. So, maybe I'm confusing you, but I think that if you look across there you'll see that the impact on subsistence is moderate in each one of these Alternatives and I don't understand that.

MMS, hopefully, is going to do a study within this next year on the likelihood of oil sticking to a bowhead's skin, that is, freshly removed skin, and we look forward to that study, if it's done well, to put this little problem to rest, hopefully. B-19

Just one more comment and that is in support of something that some other people have already mentioned, and that is that in the Kaktovik Deferral Area where the animals are known to do a lot of feeding, the Borough, as you may remember, I think it was the last Beaufort Lease Sale, objected very strongly to leasing that area and I believe in response to the Borough's concerns a 2-year study on the importance of that area from a feeding point of view was begun. That 2-year study just concluded the field season, and as far as we know the results won't be available until maybe March, April, something on that order.

So, it seems to me that, number one, one good field season, which is all that was gotten, is probably not enough to determine how important the area is, and that's what we asked for in the beginning. And in any event, that area shouldn't be leased until the existing studies, the existing 2-year study, is evaluated, and if someone could show that that area is not critical to the bowhead as far as the feeding area, then a lot of our comments, maybe, would evaporate. B-20

If a study is a progress, short as it is, then you should wait until you get the results on it.

I think it's inappropriate to lease that area until studies are done to evaluate it in response to the concerns that I think we raised in 1984 and that's all I have. Thank you.

6. Mike Philo, NSB, Department of Wildlife Management.

The first thing I want to say is that I fully agree with the comments that Tom Albert just made about the lack of change in created effects across that table. You can see those even more clearly in Table S-1, if you look at items 1 through 9, I believe, which concern animal and plant species plus subsistence harvest. I think you'll find that in only two instances does the effect decrease at all from the proposal to the alternative. There actually is no change. B-21

4

On pages IV-B-53, paragraph 2, and again on page IV-B-56, paragraph 2, the concept of habituation is mentioned and it states that whales are likely to habituate and perhaps already have, to some extent, to acoustic disturbances. Yet, in neither of those locations is there any hard evidence cited to show that. I don't think there is. I think that there has been speculation in the past that there has been habituation, but I don't think it has been shown.

It also states on page IV-B-53, paragraph 2, that seismic noise, especially the high resolution seismic surveys, probably have little or no effect. Pipeline installation is mentioned on IV-B-50, paragraph 3, and vessel activity is mentioned on page IV-B-52, paragraph 2.

The problem I have with these, there's a lot of research being done now on acoustic effects and that's good. The problem is, it's difficult to get data just by the nature of the problem and it's even harder to use that data to make predictions about bowhead whale migration or effects on feeding or mating behaviors.

What I'm getting at is that it needs to be made crystal clear to the people who will be reading the Final EIS which statements are based on solid evidence and which are more speculative. B-22

The second general comment, then, has to do with another case where the potential effects of exploration are underestimated.

I was surprised to read on page IV-B-54, paragraph 3, which is like a summary, that as a result of an oil spill a few mammals might be affected.

I was likewise surprised to see that the potential effect was listed as minor.

What I would suggest is that, according to the definitions in Table S-2, that the potential effect on bowhead whales is not minor, but major, because if there is an oil spill, whether it be into a lead or from the ice as it melts and goes into a lead, not just a few bowhead whales but potentially the majority, if not the whole population, could be exposed to that oil spill.

If calves are killed in an oil spill or if pregnant females are killed or abort or if the reproductive capability of individuals is compromised in the future because of an oil spill, this would, in fact, take several to many generations to recover and that fits better under the definition of major. B-23

I'd like to refer you to the worst case analysis, which is on pages IV-I, 1 through 3, and the comment I have to make about that is that it is likewise underestimated. The worst case effect there is listed as moderate and based on comments I just made, I believe it should be major.

And I think that the description in the worst case analysis is far too conservative and needs to be reconsidered. B-24

I'd like to have you consider next the effects on the subsistence hunt. In the text, it's listed as moderate, I believe, but if we consider that a spill may occur in midstream or being leached from the ice into the lead, I think it's easy to see where the spring hunt could be terminated because of real and perceived concerns over the ingestion of contaminated whales. B-25

Whether any whales are obviously affected by a spill or not, I would fully expect that in such a case the International Whaling Commission would finance [finish] a subsistence harvest until an analysis of the effects on the population could be made. If that happens, I'm sure that would preclude the subsistence harvest, prevent a subsistence harvest for a number of years. And, incidentally, that would be under the definition of major effect. B-26

I think that the Barrow Deferral Area should, in fact, be deferred because, number one, because of the lack of information regarding the facts of exploration on bowhead whales and other species as well, even though I didn't mention it; and, number two, because of the potentially decimating effects a spill could have on the bowhead whale population and the subsistence harvest. B-27

7. Flossie Hopson Anderson.

Although I have not read the EIS page by page or word for word, I am aware that the lease sale covers the entire coastal area from the border to Point Hope. B-28

I would like to make a few observations and recommendations about this lease sale. It seems pretty premature to me at this time to decide to have a lease sale, to have an extensive offshore lease sale in this whole area because of the predestined offshore development in the ANWR region, the Arctic National Wildlife Refuge, which is being considered by Congress to be opened up for future development. B-29

Back in the 70's, there was a concern about development in certain areas. The concern was that there would be similar Prudhoe Bay units all across the slope and this is what this sale will do, develop Prudhoe Bay units all across the coastline. B-30

Doing research on noise disturbance will not solve the problem, or setting up instrumentation stations will not solve the problem. Those are only research. Seasonal restrictions must be in place. The Inupiat people should not be forced to compromise what is there. For over 10 years now, Inupiat people have been telling you not to have a lease sale, here and there offshore, because--but are they ever heeded in what they say?

We have been telling you the same information for years now, but they're never included in your EIS. Inupiat people will continue to use subsistence resources such as bowhead whales, seals, belugas, seabirds, polar bears, caribou, and fish, as long as we are here. For thousands of years now, Inupiat people survived on these resources.

With development all over the coastline, that will be no longer true. Undisturbed areas are very significant, especially those areas with major rivers and estuaries that provide the habitat for our resources. B-31

Does industry have the capability to clean up a major oil spill or blowout? Can you envision what a major blowout will do to the habitat and its resources? B-32

It just so happens that a major blowout has not occurred in Prudhoe Bay to see if the capability exists. B-33

Specific areas that lie in proximity to established villages like Barrow, Kaktovik, Nuiqsut, Wainwright, and Point Hope need protective measures to keep the areas undisturbed. B-34

Major areas for whaling must be deleted to save the species and to save the Inupiat way of life. The area, especially around Kaktovik, which is used for feeding grounds, must be deleted. The migratory patterns and the routes of the bowhead whales is very sensitive. These areas must receive the highest priority for deletion. B-35

It seems to me the sale, if unchanged, is destined to destroy the Inupiat way of life by endangering the marine mammals' cycle and habitat. Mitigating measures must be in place before any development occurs. Simply activating research programs will not solve the problem. The problem is the user will be restricted to its resources if there ever was a major spill or blowup. B-36

8. Geoff Carrol, NSB, Department of Wildlife Management.

In the EIS one of the reasons given for the Barrow Deferral on page 226 is that in the fall bowheads feed in the area east of Point Barrow. I'd like to add to that, that the Point Barrow area is also periodically an important feeding area in the spring.

In the spring of 1985, each of the three whales that were harvested during the spring hunt had over five liters of food in their stomachs. This food was mostly (INDISCERNIBLE). The feeding behavior was observed by ice-based observers, being a half kilometer southwest from Point Barrow from May 26th to the 6th of June, 1985.

During the time, at least 60 individuals were seen feeding over a period of 12 days. There were over 12 individuals feeding at the time and individuals were seen in the area up to 15 hours repeatedly. B-37

The feeding was spread over a considerable time and distance. Stomach contents were collected from the whale on the 9th of May and feeding behavior was observed through the 6th of June when we had to leave the ice because it became unsafe. So, the feeding activity took over 3 weeks.

Bowhead whales which are harvested presumably feed south of the village of Barrow and whales were seen feeding north of Point Barrow so this feeding activity was spread over an area of approximately 36 kilometers or 22 miles.

In 1986 whales were also seen feeding along the ice edge during the first and second weeks of June.

Added to that, I'd like to make a couple of comments as to why the whales are especially susceptible to the oil development in the Barrow Deferral Area and these are that while it's true that the migration is spread out from early April through June, the majority of the population passes by usually in a B-38

fairly short time. We have days there in the census when we'd see 300 whales go by in a day. So, there's a potential that if there was an accident at the wrong time the majority of the population could be affected.

This is also true with the calf passage.

Now, the extreme example of large numbers of whales passing in a short period of time came in 1980 when they were blocked by ice for most of the season and 95 percent of the population came through in 6 days

Now, the same thing is true with calves. They are seen from mid-April through early June, but generally a majority of the calves pass by in a short time also. For example, during the spring of 1986, over half of the 59 calves that we saw passed between the dates of May 24th and June 2nd.

9. Joash Tuckle (spoke in Inupiaq)

And this last fall whaling season, I was whaling from September through November and all we saw were three whales. Where was all this other number? Where did all these other whales that passed by through Barrow, which route did they take coming back from the east? B-39

From this side of Prudhoe Bay there has been sighted a lot of whales, but every good day starting from September to November, every good day that the waters are calm, we go out hunting from the Barrow area, but we never did sight any whales.

There must have been something down there where you have that area marked. There must be something going on down there that the whales did not take this route where they usually take, what we call the short-cut.

If anything as minor as what you have down there in this area where you have marked off, how much more if the industry begins? The oil companies set up camps right in the area. How much more disturbance with all that noise, all that industry going on, how much more? Which way will those whales--which route should the whales take if a little thing like whatever is down there in the ocean where you have it marked, if a little thing like that can get them to take another route, which route are they going to take once dangerous industry starts drilling down there on the offshore drilling? B-40

During this last fall I was out hunting, trying to locate where all the whales were because there were so many of them passing through there going east. I was trying to find out what route they were taking so I spent 2 days and 2 nights out in the Beaufort Sea with just a small boat.

As I was being raised on meat, I want to have this opportunity once again to feed my folks, at least one of them while they are still alive, to have something fresh, to present something fresh for them to eat like the way they raised me on this fresh meat, but for some reason, for some little disturbance there was in the Barrow area under the water, if that little thing can--the whales in their sensitivity can take another route when you can't see anything on top of the water, if they have that sensitivity within them by taking another route instead of coming in through Barrow, that was one of the reasons why.

The first school of whales that pass by through here don't have the calves with them, traveling with them.

The female whales, with their young, follow right behind these. They're the last school of whales that pass by.

Until the last of the females whales, with their calves, soon after they are all gone, that's when the migration stops.

So, if you want to start this offshore drilling near Barrow, you are to wait until all female whales have passed through with their calves. But do not say that I have seen some whales with their calves, let's start. You should not have that attitude. B-41

So, when the majority of the whales have passed by, the last school of the whales are the reproductive ones, the female ones and their calves, but if you start drilling while there are still some female whales with their calves that have not yet arrived here in Barrow and if the oil spill occurs or the blowout occurs, that is when the bowhead whale will be extinct.

10. Daniel Leavitt (spoke in Inupiaq). No response to testimony required.

11. Arnold Brower, Jr., Chairman, AEWC.

I enjoyed what Joash had to say because I was one of those whaling captains that was out whaling. There was definitely a noise disturbance off Point Barrow and that noise disturbance, Lon (phonetic spelling) and I and several other community members, perhaps one of your agents know, we tried to get that ship out of the Point Barrow area during our subsistence hunting, but there was a priority reason, rationale, that we were told that it is carrying somebody doing bird studies, a scientist. B-42

As I just skim through the Draft Environmental Impact Statement, I get disturbed and start to think about who wrote it. There was [a] list, maybe three pages long, that you would confer with in the Draft Environmental Impact Statement. In the formulation of it, perhaps, I felt that Exxon, Sohio, Atlantic Richfield, and those agents drafted this Draft Environmental Impact Statement for you and you produced the cover. B-43

The area that I would very much be concerned with before the Minerals Management Services is to strengthen Stipulation #4 to the maximum extent possible so that it could endorse the proper management so that the bowhead stock would grow back to a healthy stock. Perhaps we could work together to relieve its classification from endangered species. B-44

Within your Draft Environmental Impact Statement there is a page III-53, which somebody brought my attention to and I made some notation on it. I know that the Minerals Management Service, the Federal Government, and other entities as well as the industry and the media take this kind of document verbatim. B-45

Down toward the middle of the page, there is a subsection (a), bowhead whales, and then down toward the last statement, next to the last statement, it is stated, the sharing of the bowhead is central to nalukataq, Thanksgiving, and Christmas feasts, and muktuk is shared extensively with communities as far away as Fairbanks and Anchorage.

I would like that statement to be restated: "With Eskimo residents in communities as far away as Fairbanks and Anchorage."

On page IV-B-50, the first approach disturbs the whales. That's an interesting notation. And the reactions include changes in orientation and behavior or dispersal. B-46

That is the response from what you call a minor, in your book, but it is a major impact, detrimental impact to bowhead whalers. It is not a negligible impact, it is a major impact.

On page IV-B-52, the second paragraph, it states on the third statement, it indicates that bowheads probably would avoid approaching within several kilometers of vessels attending a drilling unit and probably would move away from the vessels that approach within a few kilometers. B-47

The whale would not go out just several kilometers. It would go as far away as possible. If it sighted, if the noise is in the particular area out of Point Barrow, as soon as it hears it, it will go around as far as possible and migrate, take its normal migration pattern.

In that same paragraph it says that vessel activities associated with the sale are not expected to disrupt the bowhead whale migration and small deflections in individual bowhead migration paths and a reduction in use of one of several areas of bowhead feeding habitat should not adversely affect the species.

Perhaps they will not adversely affect the species from their normal migration, but it will adversely affect the migration route, displace the whales from subsistence availability, it will break the provision of ANILCA 810. Federal responsibility to the Natives was in subsistence hunting. B-48

I believe Minerals Management Services is not qualified to make such a statement like that.

Under the summary on page IV-B-54, under Summary (A), I believe Mike also brought this issue up and I support his position, that it's not a minor thing, it's a major impact.

The area that I underlined, that I believe would have the most detrimental impact, is the next to the last statement in that summary. Reactions are expected to be short-term and temporary in nature, consisting of movements away from the south shores. However, whales may avoid feeding within several hundred meters of drilling units and production platforms. B-49

I think there again, you have no qualification to make that statement. Whales may avoid feeding within several hundred meters. I would replace meters with miles.

And, again, under conclusions, the combined potential effects on bowhead whales of activity associated with the proposal would be minor. That would be a major for me. B-50

12. Doris Maupin. No response to testimony required.

11

Response B-1

The Secretary of the Interior has the option of deferring from the Sale 97 proposed area any or all of the deferral areas analyzed in the FEIS or areas proposed after consultation with the Governor of Alaska, pursuant to Section 19 of the OCSLA, as amended.

Response B-2

This concern was addressed in Section IV.B.9.a.(2)(a) and Section IV-I of the EIS.

Also, see Responses 7-14 and 8-2.

Response B-3

This concern is addressed in Response 8-7.

Response B-4

By proposing the deferral alternatives, MMS recognizes the concern that residents of the North Slope and public and private organizations have regarding the biological resources of the Barrow and Kaktovik Deferral Areas. The Secretary of the Interior has the option of deferring from the Sale 97 proposed area any or all of the deferral areas analyzed in the FEIS or areas proposed after consultation with the Governor of Alaska, pursuant to Section 19 of the OCSLA, as amended.

Also, see Responses 6-2 and 6-3.

Response B-5

This concern is addressed in Response 21-11. Also, see Appendix D of the EIS.

Response B-6

The EIS does address possible oil-spill effects on subsistence harvests; see Sections IV.B.9.b(1) through (4). Effects from oil spills are discussed for the biological resources that are associated with the major scoping issues; see Table I-D-1.

Response B-7

This concern is addressed in Section IV.B.2. Also, rates of pipeline trenching and laying are presented in Section IV.A.3.a(3)(a) of the FEIS, and the area that would be disturbed by pipeline-trenching activities is presented in Appendix G, Table G-12. These figures suggest that disturbances in nearshore areas (within several kilometers of shore) should last only for a few days. Thus, such activities are expected to have only very localized and temporary effects on anadromous fishes.

The effects of offshore pipelines on marine mammal migrations are analyzed in Section IV.B.4.a(1). The effects on caribou movements of an onshore pipeline

1

linking leased Sale 97 blocks west of Barrow and TAP are discussed in Section IV.B.6.a(3)(c).

Response B-8

The possibility that the oil companies would restrict hunting and travel near the pipeline corridor has been analyzed in this EIS (see Sec. IV.B.2.6). The EIS has found that while such restrictions would cause an inconvenience, passage over the pipeline would still be possible, and harvest of terrestrial mammals should not decrease.

Response B-9

The MMS has prepared measures to reduce or eliminate the threat that oil exploration may have to the subsistence harvest of bowhead whales. These measures include: (1) Stipulation No. 4--Seasonal Drilling Restriction for Protection of Bowhead Whales from Potential Effects of Oil Spills--which does not allow exploratory drilling, testing, and other downhole exploratory activities during the spring (April 15 through June 15) or fall (August 1 through October 31) bowhead whale migrations; (2) Information to Lessees No. 5--Information on Subsistence Whaling and Other Subsistence Activities--which also provides information to the lessees regarding bowhead whaling areas and timing of bowhead whaling activities; lessees are advised that operations should be conducted so as to avoid unnecessary interference with subsistence harvests.

The Cooperative Oil/Whalers agreement between the oil industry and the Kaktovik and Nuiqsut whaling captains in 1986 was a good indication of the seriousness of the oil industry to attempt to cooperate with the whalers. This cooperative program was highly successful and hopefully will be continued.

Response B-10

Aerial surveys of the bowhead migration through the Alaskan Beaufort Sea have been flown for the past 8 years to look for potential changes in the whales' migration route and distribution that may have been caused by noise from OCS oil and gas exploration activities. No significant changes in distribution during recent years were observed other than that the bowhead migration was farther offshore during 1983 than in years previous or years since (Ljungblad et al., 1986). This shift in the 1983 migration appears to have been caused more by the heavy ice conditions and not the relatively small amount of noise resulting from industrial activity.

Response B-11

The effect of noise on the subsistence hunting of bowhead whales is one of the specific concerns of the major scoping issues that are analyzed in the Sale 97 FEIS; see Section IV.B.2.a and Table I-D-1. The analysis indicates that, while at Wainwright noise and traffic disturbance from the construction of a pipeline landfall at Point Belcher may have a MAJOR effect on subsistence whaling, such high effects are not expected elsewhere. Section IV.B.2.a also noted important agreements between industry and the IWC that, in the past, have mitigated noise conflicts. In addition, MMS has evaluated a Seasonal

Drilling Restriction, Stipulation No. 4, prohibiting exploration drilling, testing, and other downhole exploratory activities during the bowhead whale migration. While this stipulation is aimed at protecting the bowhead from oil spills by eliminating most industrial noises during the bowhead migration, it would also protect subsistence whaling.

Response B-12

Inasmuch as the seasonal drilling restriction would be initiated with the start of the bowhead migration, it would be in effect during bowhead subsistence hunts. Stipulation 4 was designed to protect the bowhead whale population from oil spills, whereas ITL 7 was designed to protect bowhead whales from noise disturbance. Consequently, should artificial-island construction for exploratory operations occur during the bowhead migration, the Regional Supervisor, Field Operations, could halt construction operations if significant numbers of bowhead whales were present in the vicinity and jeopardy to the species appeared to be likely.

Stipulation 4 would apply to exploratory activities only. The need for and type of restrictions on development and production activities, including construction of subsea pipelines, would be subject to separate NEPA and regulatory review at the time a site-specific development and production plan is submitted. A separate biological opinion will also be furnished by NMFS for these activities.

Response B-13

This concern is addressed in Response 8-4.

Response B-14

The potential effects of oil ingestion by polar bears and the effects that oil contact could have on polar bears as well on other marine mammals are discussed in Sections IV.B.4.a(1)(a), (b), (c), (d), and (e).

Response B-15

The MMS has funded studies to investigate the distribution and abundance of ringed seals--the primary food of polar bears in the Beaufort Sea. The FWS is the Federal agency with management jurisdiction of polar bear populations in the U.S. and is reponsible for studying the distribution, abundance, and life history of polar bears in Alaska.

See also Responses 6-2 and 6-3.

Response B-16

The Secretary of the Interior has the option of deferring from the Sale 97 proposed area any or all of the deferral areas analyzed in the FEIS or areas proposed after consultation with the Governor of Alaska, pursuant to Section 19 of the OCSLA, as amended.

Response B-17

Given the relatively low resource estimates for the sale area and the resultant low level of exploration and production activities expected as a result of the sale, we believe that effects on the bowhead whale would be MINOR. Under existing technology, we would expect little, if any, exploration activity in the area of the spring lead system during the bowhead migration due to the prevailing severe ice conditions.

Also, see Response 2-1.

Response B-18

This concern is addressed in Response 2-1.

Response B-19

The MMS had hoped to fund a study on the likelihood of oil sticking to freshly removed bowhead skin. Unfortunately, due to a lack of interest in conducting such a study on the part of private companies and Government laboratories that might be qualified to do such work, the study has been cancelled.

Response B-20

This concern is addressed in Response 8-7.

Response B-21

This concern is addressed in Response 2-1.

Response B-22

Response 21-24 discusses our rationale for believing that habituation is likely to occur in bowhead whales. It would, however, be very difficult to prove that habituation had occurred to a common noise such as distant seismic sounds since, undoubtedly, nearly all bowheads in the western arctic population have already been exposed to such noise. About the only way to prove habituation could occur would be to introduce an unfamiliar sound in the presence of bowheads to which the whales would initially react. After quantifying the whales' initial reaction to the new sound, the investigator would then, over a period of time, repeat the new sound. If the whales' reaction lessens over time and does not appear to be a matter of simple fatigue, then it could be said that habituation had occurred. The assumption would then be made that if bowheads could habituate to this new, unfamiliar sound, they probably had habituated to the distant seismic sounds. The evidence that bowhead whales appear to migrate normally across the Alaskan Beaufort Sea, despite the fact that seismic sound is so widespread, indicates that bowheads may have habituated to at least lower intensity levels of this sound.

We acknowledge your concern that some predictions are more speculative than others; however, we believe that the assessments we have made are reasonable conclusions drawn from the available evidence.

Response B-23

This concern is addressed in Responses 7-10, 7-14, and 21-26.

Response B-24

The MMS believes that the worst-case analysis presents an extreme scenario and that the projected level of effects is supported by current scientific literature and sound professional judgment.

Response B-25

If an oil spill contacted a spring ice lead, the spring whale hunt could be terminated for the year--a MODERATE effect; see Table S-2.

This concern also is addressed in Response 8-20.

Response B-26

This concern is addressed in Response 8-20.

Response B-27

The MMS believes that there is adequate information about effects of exploration on bowhead whales and other species to make a reasoned choice among alternatives. The effects of the proposal on the bowhead whale and subsistence harvests, including potential oil spills, are expected to be MINOR and MODERATE, respectively. Oil spills are not expected to decimate the resource, as you have stated.

Response B-28

The proposed Sale 97 area covers the Alaskan Beaufort Sea coastal area from the Alaska-Canada border to Point Barrow and the Alaskan Chukchi Sea coastal area from Point Barrow to just north of Peard Bay.

Response B-29

The Sale 87 EIS also covered the OCS area north of ANWR; about 100 blocks were leased in this area as a result of the sale. Congressional action on the future of petroleum exploitation in ANWR is pending.

Also, see Response A-42.

Response B-30

Until the petroleum resources of the North Slope area and the Beaufort Sea are determined, the number, size, and location of petroleum production and support facilities are unknown.

Response B-31

The effects of noise on the biological resources used for subsistence purposes are acknowledged as specific concerns with regard to the major scoping issues, and the effects of noise on these biological resources are analyzed in the FEIS: see Table I-D-1. In addition, measures are proposed by MMS to mitigate those activities that might disturb the subsistence resources: see Response 8-23.

Response B-32

This concern is addressed in Section IV.A.2. Industry has the capability to respond to a major spill, whether it is from a blowout or another cause. Unfortunately, the capability to respond cannot be equated with any guarantee that the bulk of the spilled oil would be either recovered or burned. Historically, recovery and/or burning efforts have been more successful for blowouts than for other types of oil spills because there are several major response advantages that blowouts provide: (1) blowouts often accidentally catch fire--or can be deliberately set on fire--burning up rather than spilling most of the oil; (2) major blowouts are long-term events, allowing time to mobilize and deploy more equipment; therefore, more spilled oil can be recovered than for instantaneous spills of the same magnitude; and (3) blowouts occur at the platform, where there would be a detailed, site-specific response plan plus onsite-response equipment and crew.

Response B-33

The concern about the effects of a major blowout on the biological resources of the Beaufort Sea and North Slope of Alaska is addressed in the effects of oil spills portion of Sections IV.B.1 through IV.B.6 of the EIS.

Response B-34

As noted in Section II.3.1, MMS had evaluated (1) deferral alternatives that would remove from leasing two areas used for subsistence-hunting purposes, (2) five stipulations to reduce or eliminate the effects of petroleum exploitation, and (3) seven ITL's that inform lease operators of special concerns in or near the leased areas. Other stipulations or ITL's can be considered in each lease resulting from Sale 97 through negotiations with the affected states pursuant to Section 19 of the OCSLA, as amended.

Response B-35

A part of the unleased area in the eastern Beaufort Sea north and east of Kaktovik has been analyzed as a deferral area; see Figure 1-1 and Section II.B.2.d. The Secretary of the Interior has the option of deferring from the Sale 97 proposed area any or all of the deferral areas analyzed in the FEIS or areas proposed after consultation with the Governor of Alaska, pursuant to Section 19 of the OCSLA, as amended.

Response B-36

Through the scoping process, MMS has analyzed a number of mitigating measures (Sec. II.B.1.c) to help eliminate or reduce the threat that petroleum exploitation poses to the environment. The exploration plans and development and production plans submitted in accordance with 30 CFR 250.34 will confirm

information about specific sites affected by proposed facilities. The public is provided an opportunity to comment on these plans, and additional mitigating measures can be proposed.

Response B-37

Section III.B.5.a has been amended to address this concern. Thank you for the information.

Response B-38

Response 7-14 describes the fate and behavior of oil in the lead system, and Response 8-2 further describes how this oil could affect migrating bowheads. As discussed in these responses, oil would not be expected to cover the entire surface of a major lead but would quickly be blown to the downwind edge. Only in small pools and cracks sheltered from the wind would oil be expected to cover the entire surface area. Toxic concentrations of petroleum vapors should not persist for more than a few hours (Geraci and St. Aubin, 1986), and with spilled oil concentrated along the downwind edge of the lead, vapors would be carried away from the lead by the wind. Consequently, we would expect only MINOR effects on the bowhead whale even if an oil spill were to occur at the time of a migratory pulse.

Response B-39

During the fall bowhead whale aerial-survey flights of 1986, seven bowhead whales were observed migrating westward through the Beaufort Sea in the area from north of Smith Bay to Point Barrow. This is about equal to the average for the past 5 years of surveys. The whales were swimming at an average depth of about 18 meters, which is the same average depth at which the whales were seen in 1984 but is somewhat shallower than the 5-year average (48 m). West of Point Barrow, only four bowheads were seen along 10,780 kilometers of aerial transect west of 157°W longitude and south of 72°N latitude. This seems to be a rather low siting rate and may indicate that bowheads, after passing Point Barrow, migrated westward across the Chukchi Sea north of 72°N latitude rather than moving southwestward along the Alaskan coast (Ljungblad et al., written comm., 1987; Montague, oral comm., 1987).

Response B-40

The commenter thought there was some type of device on the seafloor that was frightening the whales and causing them to move farther offshore. The MMS is not aware of any such device or devices in place on the seafloor. It might be possible that, with the relatively light ice conditions prevailing during the fall of 1986, the bowheads took a more northerly migration route.

Response B-41

The MMS has evaluated a potential mitigating measure, Stipulation Number 4, that would prohibit exploratory drilling in and near the spring lead system used by the bowhead whale during the spring migration, generally from April 15 through June 15.

Response B-42

This concern is addressed in Response B-40.

Response B-43

Section VI lists the various organizations and individuals consulted to obtain descriptive information, to identify effects and issues, and to identify effective mitigating measures and reasonable alternatives to the proposal. This list also includes various local government and Native organizations. Contributing authors and supporting staff members are listed in Section VI.E.

Response B-44

The MMS believes the proposed lease sale and accompanying exploration and development and production activities can be accomplished without adversely affecting the western arctic bowhead stock or impeding its growth and return to nonendangered status.

Response B-45

Section III.C.3.b(2)(a) has been amended to address this concern.

Response B-46

The overflight of an aircraft is categorized as a minor effect on the bowhead whale--because in most case, the aircraft would make a single pass over the whales and thus the aircraft noise would be evident in the water for only a brief time (less than 90 seconds) (Greene, 1985), the whales should resume their normal activities within minutes.

In Section IV.B.9a(3)(a), Effects on Subsistence-Harvest Patterns, there is an analysis of the effects of noise and disturbance on bowhead whaling. A major effect on the bowhead harvest is expected in Wainwright from disturbance due to construction activities if a pipeline landfall at or near Point Belcher is constructed. In other communities, noise and traffic disturbance could cause the bowhead whale harvest to become locally unavailable for a year--a MODERATE effect. While noise and traffic disturbance could have a MODERATE or MAJOR effect on the bowhead whale harvest, it would have only a MINOR effect on the whale population.

Response B-47

Bowheads were observed in the Canadian Beaufort Sea to turn away from approaching vessels at up to 4 kilometers and to increase their swimming speed when oncoming vessels approached within 2 kilometers (Richardson et al., 1985a). Therefore, we believe our statement to be accurate.

Response B-48

See Response B-46.

Response B-49

Section IV.B.5.b(1)(a) has been amended to address this concern. Bowhead whales have been seen feeding within 20 kilometers of active drillships on several occasions in the Canadian Beaufort Sea (Richardson et al., 1985a). It does not seem reasonable to assume that bowheads would be displaced hundreds of miles.

Response B-50

The effects of the proposal on the whales themselves are expected to be MINOR; however, effects on subsistence-harvest patterns are expected to be MODERATE. Also, see Response 21-26.

Kaktovik Public Hearing (December 11, 1986)--Excerpts

1. James Savok, Jr., NSB, Planning Department. See Barrow Public Hearing.

2. Loren Ahlers, Mayor, Kaktovik.

I would like to stress a little further the need for the Kaktovik withdrawal. We have current studies going on to determine what the effect of drilling is on the whales and the migration in this area and the extent that the feeding area around Kaktovik and east of Kaktovik has upon the whale. Until these studies are completed, further leasing of this area should certainly be deferred or put off until it's really determined what type of effect the drilling has on it.

We have at this time, actually, a good -- I hate to say it, but a good area to study because there is prior leasing and there is drilling activity taking place in only one area. That creates a very excellent opportunity to gather information and determine whether or not further leasing is advisable and we should use that. That's item one. K-1

Another thing that came out in the pre-discussion here, the off-the-record discussion, was that you're not concerned about a spring migration of whales and I think you should be concerned about a spring migration of whales. The whales do not get over in Canada by flying. They do migrate and they do migrate in this water out here. Just exactly where or at what times, I don't know if anybody knows yet. Have there been any studies in that area? K-2

3. Susie Akootchook.

I like what the North Slope Borough has written up about the deferral of the Kaktovik area and the Barrow area and I would like to stress my feeling about the Kaktovik Area Deferral. I would like to see that it be extended for 5 years because they're doing a study right now, like Loren says, they're still doing a study on there. K-3

We do have, I'm going to mention this, besides the bowhead we have spring seal hunting that goes on during the springtime and I'd like to see no exploration going on out there during springtime because they do go out there and seal hunt. We do have a number of seals and on top of that we have a variety of marine mammals out there. K-4

To get back to what Loren said about doing a study in May and April when the whales start migrating, you mentioned that you guys have the impression that the whales go out over further out there. What I feel would be good is that we do a spring study, somehow start a spring study out there because who knows, maybe those whales come up a little closer this way than just going all the way out that way. K-5

4. Issac Akootchook (spoke in Inupiaq).

The whales that we're talking about, seals should be included in all the animals. Seals and bearded seals and fish and these have got to be studied also, how they migrate and stuff like that. K-6

The ones that are not in studies are the seal holes, you know, the breathing holes that the seals have. If the drill rig is put on that, nobody knows where they're at. So, that is very crucial for the animals.

The only way that we know where the animals are is when they surface on the ice. They're visible. That's the only time that we know. He mentioned that there are breathing holes for the seals that are all over the ice in this area. K-7

And there's a fish traveling in the waters. There's migrations going on, but they don't know what kind of fish there are migrating down there too. So, studies need to be thorough in this. K-8

5. Jonas Ningeok (spoke in Inupiaq).

He says that about a quarter mile offshore the whales come around to feed along the shallow waters. If the ships are around, they don't come around at all, but if the ships are gone, then they come back. They come back for feedings and as long as there is noise they don't come around at all. They stay away.

And he mentioned that when they were out camping they could even hear the whales feeding in the shallow waters and there are lots of them that come around. He said that he could hear this and this has to be known, he says. K-9

6. Archie Brower. No response to testimony required.

7. Herman Rexford (spoke in Inupiaq).

When the oil ships are around here it affects the migrations of the whales and he would like to see no ships during the fall whaling at Kaktovik and no exploration during that time because this is the only time that they can hunt whales. He knows that the ships are very noisy and can affect the whaling route. K-10

And he's concerned about this drill rig, the ship that can drill from the ship, and he says that he has seen, all of us have seen the land drilling and they're visible, but he has never seen any ships drill, drillings from the ships, and he would like to see that there is no danger in this if there is one. And he said that it has to be sturdy from the high waves and from crushing and stuff like that. K-11

Response K-1

The bowhead-feeding study final report should be completed by about June 1987, and this information will be made available to the Secretary of the Interior prior to his decision on whether or not to defer the Kaktovik area.

Regarding studies of the effects of drilling activities on bowhead whales, if it appeared that drilling activities would have the potential for causing serious adverse effects on the whales such that the species would likely be jeopardized, the MMS Regional Supervisor, Field Operations, would limit or suspend such activities to avoid adverse effects on the whales.

Response K-2

The bowhead spring migration is depicted in Figure III-10. Sightings north of Kaktovik during the spring migration have been far offshore, north of the proposed sale area. Aerial surveys of the bowhead spring migration were conducted by an MMS contractor during the years 1980 through 1984.

Response K-3

The fieldwork for the bowhead-feeding study has been completed, and the final report should be completed by June 1987.

Response K-4

As noted in Section II.B.1.c, MMS has evaluated the following potential mitigating measures: (1) a stipulation, Number 4, to prohibit downhole exploratory-drilling activities during the spring and fall bowhead whale migrations; (2) a stipulation, Number 2, requiring all personnel involved in exploration and development and production activities to be informed of specific environmental, social, and cultural concerns; and (3) an ITL, Number 5, informing all personnel involved in petroleum activities of the importance of Native subsistence activities.

Response K-5

This concern is addressed in Response K-2.

Response K-6

Discussion of fish-migration patterns is presented in Sections III.B.2 and IV.B.2. Continuing research in this area is being performed by environmental consulting firms under contract to oil companies, as well as by the FWS through funding from MMS; see Appendix D.

MMS has conducted numerous biological studies on the life history, distribution, abundance, migration, and feeding habits of whales, seals and walruses, and fishes in the Beaufort Sea and the Sale 97 area. See Appendix D, MMS Alaska OCS Region Environmental Studies Program.

Response K-7

A study of the distribution of seal holes and seal lairs in the Beaufort and Chukchi Seas and the effects of seismic oil-exploration activities on seal use of holes and lairs was conducted in 1981 and 1982 (see Burns and Kelly, 1982). (Also, see App. D, which lists the study, Direct Effects of Acoustic Disturbance Sources on Ringed Seal Reproductive Behavior, Vocalization, and Communication, RU 636.)

Response K-8

This concern is addressed in Response K-6.

Response K-9

The MMS appreciates the information you have provided. As we have discussed in the EIS, industrial noise can be transmitted a considerable distance underwater, and whales will avoid this noise if it becomes too loud or bothersome.

Response K-10

This concern is addressed in Response K-1.

Response K-11

The technologies that have been or may be used to drill exploration wells in the Beaufort Sea are described in Section III.A.3.

Nuiqsut Public Hearing (December 11, 1986)--Excerpts

1. James Savok, Jr., NSB, Planning Department. See Barrow Public Hearing.

2. Maggie Kowalski, Mayor, Kaktovik.

We were so concerned when we heard that they would like 50 percent of the whales to pass and then they will start continuing their drilling. We wanted the Whaling Commission to know we were very concerned to put it up at least to 75 percent if not higher because it's a very critical time of the year for our whalers to be down there risking their lives and the weather conditions and the ice movement.

We weren't too sure if they were aware of how bad the ice movement is happening down there. I think they had to go all the way to the islands down there to do their whaling, to camp out and then go out from there. So, when we had heard that they had put 50 percent for the whale migration to go by, we were very concerned. So, we called Ronald Kalikat, he was representing the Alaska Whaling Commission at that time, to write in the concern of the people here and also the whalers to put it up to at least 75 percent or higher. N-1

And they were also concerned about the noise, how it affects the whale at the time that it's going by there if they continue to do their exploring. So, they were very concerned about that and that's why they thought -- while they're out there for the exploring to stop until at least they got a whale or their quota of whales. N-2

Yes. That's what I was going to say, I wanted to request that there is a possibility of deleting that area where we do our whaling. We would like to put it on the map. I think that we have just been overlooked because in the past that was our wish. If they were going to delete the Barrow area and Kaktovik, we wanted our area where we were whaling also deleted and somehow a miscommunication has happened. N-3

But I can recall a lot of the testimonies, all of the time, when it was time for us to speak our concern. That was the concern. They never did enough studying on our whales so they had better put it off also for another 5 years or however long that [the] Kaktovik and Barrow areas are doing. N-4

3. Mark Ahmakak.

I'm quite concerned about the stipulations that have been quoted in some past EIS studies. Just recently, a judge had ruled against the suit of the North Slope Borough. It was one of the mitigating measures that was put forth by the North Slope Borough and the judge disagreed with that mitigation in which all drilling activities would have ceased by the fall season on the migratory routes and the time schedules of the whales when they passed by the Canadian side extending over to the Chukchi Sea.

I'm also aware that would have a tremendous impact. If the oil companies do obtain some of these leases, they will not obey, they will not listen to the North Slope Borough's position on account of a Federal judge or whoever at that time ruled against the mitigating measures. N-5

I have one last comment. I will immediately make it known that the deferral for the Nuiqsut area, I will expect your department to review a letter or some kind of answer for the City Council and mayor as we will probably request for the deferral on some specific numbers that are referred for deferral due to the fact that some of that ocean is used for our subsistence hunting areas of the sea mammals.

I do not foresee any problems. It is a formal request, both to the North Slope Borough and the City of Nuiqsut, that we will put our two cents worth into it and we need to ask for January 6th and also your department will receive copies of whatever comments are picked up from the community. Thank you. N-6

4. Billy Oyagak.

Last fall we had interference with the choppers and some of the ships. We were located on Cross Island and we could go all the way down to Flaxman Island. And they told us that they were going to operate on Corona only and they didn't tell us that they were going to reopen Hammerhead. Instead of going their route, the last part of September they started going through the islands with choppers and some of those supply ships weren't supposed to be where we were hunting whales and some of them just went straight out after they said we wouldn't have any interference from oilers, choppers, and supply ships.

And since they opened up the Amerith (phonetic spelling), we didn't have any whales for a week or two because we found out that they were just going back out to Captain [?]. And finally in October we finally saw some and struck. We stayed out there in that island 1 month and a week instead of coming home. That's how we whale from here and it's pretty hard.

I'd like to see you guys do something about that next time they start drilling or they've got a seismic going on in these places. Thank you. N-7

5. Nelson Ahvakana.

Now, another question that occurred that I would raise is why didn't the Minerals Management Services include a deferral for the village of Nuiqsut? As stated earlier during the beginning of the session, I was made to believe that the Minerals Management Services personnel are here primarily to hear the subsistence problems of this village. If this is the case, then this village of Nuiqsut is being relieved from the problems that I see presented. N-8

It's true that only just a handful of people would whale. That's the understanding that our Caucasian brothers have, anyway. But the philosophy behind this is that the whole village is involved when there is a whaling season opened within this village. It's not just the whalers that are out for a period of a month and a half or so and living off the land and trying to provide the quota that was established for this village. N-9

I don't see any protection for the village of Nuiqsut to be -- except for the Natives of the North Slope. N-10

It has never been considered, I believe, when the Environmental Impact Statement is being written, to supposedly to protect the environment. They talk about the waterfowl, they talk about the migration of whales, they talk about the fish, they talk about the caribou, but I have never heard anybody mention anything about the Inupiat. This is for your protection. I have never heard that.

Even though it was said many, many times that we're very, very concerned about the subsistence of this area. This subsistence is for your own good, but what good is that if the Federal Government or the State of Alaska is utilizing just the words with no meeting [meaning] whatsoever and allow the Natives to suffer. N-11

I think we need to see that, the subsistence of this area, within Nuiqsut, that it stays open to us. It presently is down to the ocean area. That's the only area that's been open presently right now. We're allowed to subside within our area here, but there's reclamations [?] that are foreign to us, especially to a person that has no education whatsoever, to find out that he is breaking the law because some John Henry over there has made that law for him.

So, in order for this village to be heard, what do we need to do? We've reported time after time what we wanted the Federal Government or the State of Alaska to hear, but nothing materialized from all that. I believe that our people are becoming kind of restless and they're becoming useless to themselves because what good does it do anything? This is how our people are feeling themselves. What good does all this do if I present myself in front of this public hearing and expand on my knowledge because I'm only one individual anyway. What good would that do for this village? N-12

6. Teresa Hopson (spoke in Inupiaq).

The damage is done to the subsistence resources and stuff like that even though they have commented and they would do something, but these are not carried through and these are one of her main concerns. N-13

7. Patsy Tuckle (spoke in Inupiaq).

He is one of the captains, whaling captains. He would like to make comments along with Teresa Hopson's. After making several comments in the past, they had no results, what's happening. After making comments, they still don't hear and the drilling is still going on even with comments or no comments. N-14

He is aware that whales are going around the area. They are not seen as they used to be any more. Helicopters are interfering and also ships are. After commenting that the helicopters would go by land, they still don't do that. The ships are still going through the migration route. N-15

All these activities are still going on. Even the ships are coming toward them when they are out whaling and after they said that they wouldn't interfere with their whaling.

He said that they've been lied to and it shows that the ships are still going through the migration and he would like that this be known. N-16

3

Response N-1

It was a State of Alaska policy decision, through the coastal zone consistency determination process, that required the suspension of drilling below threshold depth until 50 percent of the bowheads had migrated past the drill site.

Response N-2

Our current knowledge of the effects of industrial noise on bowhead whales has been summarized in Section IV.B.5.b of the EIS. Further information should become available by the summer of 1987, as reports are completed regarding the effects of drillship operations during 1986 on bowhead whales.

Response N-3

This concern is addressed in Response 9-1.

Response N-4

The MMS studies program has contracted for a number of studies to be conducted on the effects of OCS activity on bowhead whales, including 8 years of aerial surveys of the fall migration. Studies are listed in Appendix D.

Response N-5

A lawsuit was filed by the North Slope Borough (NSB) Civ. No. A86-393, (D. Alaska, filed July 31, 1986), whereby the NSB sought to enjoin oil and gas exploration activities on the OCS on certain Sale 87 leases. The NSB challenged the DOI's decision to grant a one-time exception to a stipulation that prohibited exploratory drilling during the 1986 fall-migration period of bowhead whales. The NSB requested a temporary restraining order (TRO) against the drilling activity by the oil companies based on the one-time exception. The court denied the TRO, holding that any irreparable harm to the NSB was speculative, whereas harm to the oil companies and the Federal Government was certain and substantial if the TRO was granted. A trial was not held because plaintiffs and defendants settled the case out of court. The referenced mitigating measure (protection of bowhead whales) has not been revoked. It remains a condition of every previous-sale lease located within the migratory path of the bowhead whale and is evaluated as Stipulation No. 4 for Sale 97 (see Sec. II.B.1.c).

Response N-6

This concern is addressed in Response 9-1.

Response N-7

The MMS recognizes your concern, and we have evaluated measures in the EIS that should reduce aircraft and vessel disturbance to whales and whalers (e.g., Stip. 4, ITL 1, ITL 5, and ITL 7). The MMS is limited in the types of restrictions it can place on aircraft and vessel traffic; therefore, it would probably be better to work through a cooperative group such as the Oil/Whalers Cooperative formed during 1986 should the program continue. This program, as you know, is a cooperative venture between the oil industry, the AEWC and NSB,

1

and the Kaktovik and Nuiqsut whaling captains; see Section IV.B.9.a(3)(a). The MMS is not a party to this agreement, but we commend the members of the cooperative group for coming to such an agreement.

Response N-8

This concern is addressed in Response 9-1.

Response N-9

In Section III.C.3.a, the discussion of bowhead whaling notes: "Whaling traditions include kinship-based crews; shoreline preparation for a distribution of the hunt; total community participation and sharing. . . ."

Response N-10

As noted in Section II.B.1.b, laws, regulations, or orders that provide mitigation are considered part of the proposed action. Directly or indirectly, these legal requirements have been written to reduce or eliminate the potential harmful effects petroleum-exploitation activities could have on the environment. Stipulations and deferral areas are proposed in the EIS to provide additional protection for resources or areas of concern. The reason a deferral area that incorporates the Nuiqsut bowhead whale-hunting area was not proposed is addressed in Response 9-1.

Response N-11

The effects of the proposed action on the human environment as defined by population, sociocultural systems, subsistence-harvest patterns, and the economy are analyzed in Sections IV.B.7 through 10; also, see these respective parts in Sections IV.C through IV.G for the analysis of each of the alternatives and Section IV.L for the subsistence analysis.

Response N-12

These concerns are addressed in Responses 8-23, B-4, K-4, N-13, and W-15.

Response N-13

Comments received during the scoping process, Section I.A.5 of the EIS, and in response to the draft EIS, Section I.A.6, have been used to (1) identify major issues to be analyzed in the EIS; (2) to evaluate stipulations, such as the Orientation Program--No. 2, Protection of Biological Resources--No. 3, and Seasonal Drilling Restriction--No. 5, and ITL's, such as Information on Areas of Special Biological and Cultural Sensitivity--No. 2 and Information on Subsistence Whaling and Other Subsistence Activities--No. 5; (3) to evaluate deferral areas, such as the Barrow and Kaktovik Deferral Areas; and (4) to revise those parts of the EIS that need clarification or require updating.

Although specific activities--such as exploration drilling--may not be eliminated, expressions of concern can initiate procedures to mitigate the effects

of those activities that could affect the biological resources or subsistence hunting; items (2) and (3) in the preceding paragraph are examples of those mitigating responses of concern.

Also, see Response 8-23.

Response N-14

These concerns are addressed in Response N-13.

Response N-15

This concern is addressed in Response N-7.

Wainwright Public Hearing (December 9, 1986)--Excerpts

1. Jacob Kagak, Mayor, Wainwright.

I'm just going to start what I was going to say a little while ago. This public hearing sort of surprised me because there was no prior notification to the city office that this public hearing was coming to Wainwright.

I think it caught the whole Council here by surprise too because after we made the agenda, the following day, a couple of days later, I noticed the public hearing notice was posted in our village. I didn't even have a chance to go over that big -- this one (INDICATING DEIS). W-1

2. Alma Bodfish. No response to testimony required.

3. David Panik (spoke in Inupiaq).

I have a question for you, just how the oil rig will be set up down in the ocean, down in the Beaufort Sea, just how the rig, the drilling rig, will be set up.

Is it going to be set up down on the floor of the ocean or is it going to be on top of the water, the platform for the rig? This was my first question. W-2

I have another question. This other question is about the walrus. It's not about the walrus itself, but it is about the clams that the walrus eat from the floor of the ocean. Have you ever made any locations, any findings on exactly where you can find the clams that the walrus eat because we eat the walrus and the walrus eats the clams. Have you ever found out the direct location where the clams can be found on the ocean floor? W-3

And about the whale, the plankton and anything else that the whales eat, have you ever found out exactly how they shift around in the water? This food, this thing that the whale eats, whatever it is, plankton, whatever the whale eats, have you ever found out exactly whereabout in the ocean they can be located and where they go? Because we have noticed that the whale follows all this whether it be right close to the shore or whether it be anywhere else in the ocean, just so the whale can be found where all their food is. W-4

4. Charlie Brower, NSB, Department of Wildlife Management.

After that, they'll build a pipeline if they find oil or gas on NPR 4 [NPR-A], but if they don't find oil there, they'll transfer the oil in the platforms to tankers, which will bother the whaling season, the whale hunt, and the way the tankers will be going into the open leads and the whales will be affected by the noise, the crunching of the ice, they'll try to break through the ice, and traveling in the shorefast ice that's open.

The more I read into this book, the more I find out about these things. I don't think it's very effective to have a tanker out there while they're out there whaling and stuff like that. That's the only reason I find so far that's going to transfer the oil if they find oil offshore if they don't build that pipeline across the NPR-A 4 [NPR-A]. W-5

And the other thing is, you must take subsistence impact into account because of 810 of ANILCA which is supposed to protect subsistence. If bowhead, in their migrating or feeding habitats are negatively impacted, the National Whaling Commission is likely to stop the subsistence harvest of whales and ANILCA. W-6

Yesterday I didn't even get to see the letter on Section 8 [810] of ANILCA and it's required that the Feds do the following action: 1) declare action to be found in national interest, 2) minimize amount of land to achieve the action, 3) adopt sufficient minimization to minimize the impact on subsistence. And that's wanting to take our subsistence rights on 810 ANILCA and I haven't quite figured out -- I mean, I've read a little bit of ANILCA in 810 and it's quite true that they need to realize that subsistence is the life of our area here and that's what I wanted to bring out, sir. W-7

5. James Savok, Jr., NSB, Planning Department. See Barrow Public Hearing.

6. David Kagak (spoke in Inupiaq).

And should the drilling take place out there in the sea, and if there is a blowout in one of the rigs, how are you going to clean it up right in the middle of winter? W-8

About the noise vibrations from an oil rig, whether on top of the water or from a ship. Have you found out the noise vibrations, how far they go on the water? Have you found that out? W-9

One last question. If and when there is drilling and an oil company that decides if and when to drill oil anywhere south of Wainwright, David's concern is that the people of Wainwright be notified of any kind of activity before it actually happens, any kind of drilling, any kind of resource going on. W-10

7. Billy Patkotak.

My concern is that blue area on the map there. The waters west of Point Barrow, are you aware of the much stronger prevailing currents than that east of Barrow?

Now, if a substantial amount of oil is discovered in that area, how would it be recovered? Would it be recovered by tanker or by platforms? W-11

In that area there is a migration route of marine mammals. All the villages east of that area, I am sure that they would suffer. Supposing that the oil spill happened and then it would just get out of hand and that is my main concern. W-12

Supposing a big major oil spill, I hope it never will happen, but if it does, Barrow better know about this. They had better not say yes right away. They had better advise you people to defer because if there is any major oil spill ever happens in that area, all the villages east of Wainwright through Barrow, Kaktovik, Nuiqsut, will be affected because I know, since I worked for the Coast and Geodesic Survey, the main prevailing currents at this time of the year is going south and in the summer it switches back east. W-13

8. Johnny Adams, NSB, Public Utilities.

Now, if there is oil development, will there be opportunities for employment? Will there be training for employment? Will there be necessary facilities for the public to compensate them for, you know, any compensation or anything to the Government or to the State or to the North Slope Borough? I know you said the Federal treasury. W-14

Now, is part of that money going to go into the Borough and the impacted area? And further, that I know there will be another public hearing when they start transporting that oil to the pipeline or whatever, but these things take a lot of planning, as you all know, and there's a lot of input from the local expertise and the local people about how the land and the sea operates and how it affects everybody. W-15

9. Lydia Agnasagga. No response to testimony required.

10. Roberta Smith, NSB, Planning Department.

But when you take a village the size of Wainwright or Kaktovik, what kind of growth is going to happen to those communities once exploration has taken place and they find that it's feasible to drill for oil? When are these types of issues going to be addressed? What kind of search and rescue types of things are you going to have to do?

Certainly, you're going to have to have medivacs. You're going to have accidents, those types of things. When and how are these going to be addressed? W-16

I guess one of my big concerns would be that it's really hard to watch small communities transform and grow at a rapid rate and with potential oil development you're facing that possibility in any of these communities.

It would be my concern that these types of issues be addressed and brought to the community as a part of your public hearing. I guess that's the only part that I haven't heard covered. W-17

Response W-1

The Alaska OCS Region of MMS worked through the North Slope Borough Planning Department to arrange public hearing meeting places and times with the NSB communities.

Response W-2

The technologies that have been or may be used to drill exploration wells in the Beaufort Sea are described in Section III.A.3.

Response W-3

Surveys of benthic invertebrates in the 97 Sale area are described in Section III.B.1. Description of an additional study by Stoker (1981) of benthic infauna has been added to the text. Unfortunately, as Stoker notes in his study, it is extremely difficult to adequately sample the type of burrowing clams eaten by walruses. There is some indirect evidence for locations where walrus feed in the northeastern Chukchi Sea based on markings observed on the seafloor (Phillips, personal comm., March 1986). However, little information on the distribution of clams eaten by walruses is available.

Response W-4

MMS has recently funded a study entitled "Importance of the Eastern Alaskan Beaufort Sea to Feeding Bowhead Whales" (1985) to address this concern (see App. D).

Response W-5

Information about development and production is very preliminary at this point in time. Should oil be found in commercially producible quantities, the most feasible means of transporting the oil would then be determined. Prior to any actions being taken, additional NEPA review including an EIS, if appropriate, would be prepared for any development and production plans. Also, MMS would consult with the National Marine Fisheries Service under Section 7 of the Endangered Species Act to ensure the bowhead whale would not be jeopardized by development and production activities.

Response W-6

This concern is addressed in Section I.B.3.e.

Response W-7

This concern is addressed in Section I.B.3.e.

Response W-8

This concern is addressed in Appendix C.

Response W-9

Studies have been carried out by MMS contractors to measure sound-transmission characteristics at five sites in the Alaskan Beaufort Sea. It is difficult to address the concern about noise directly because the sound-transmission characteristics vary considerably from site to site and under different weather and water conditions. Under certain conditions, sounds from a given site can be heard at a greater distance than under other conditions. As an example, we could consider drillship sounds at three exploration sites in the Beaufort Sea--Hammerhead, Erik, and Belcher. Assuming a drillship producing the same sound level were operating at each site, it would take 4.5 kilometers for the sound to diminish to 110 decibels (a level above which bowhead whales would probably respond to the sound) at Hammerhead; it would take 5.2 kilometers for the sound to diminish to 110 decibels at Erik; and it would take 2.7 kilometers for the sound to diminish to 110 decibels at Belcher (Miles et al., 1986). Therefore, based on field measurements in this example, sound transmission would be the most efficient at the Erik site and the least efficient at Belcher.

Response W-10

As noted in Section I.A.14, prior to any exploration activities on a lease, except preliminary activities, a lessee must submit an exploration plan and an environmental report to MMS for approval. Federal agencies, the State of Alaska, and the public are provided an opportunity to comment on the exploration plan.

Response W-11

The oceanographic characteristics of the region along the Chukchi Sea coast are described in Section III.A.2 of the EIS's for Sales 97 and 87. The description in the Sale 87 FEIS has been summarized and incorporated by reference into the Sale 97 EIS.

Possible production and transportation scenarios are discussed in Section II.A of the Sale 97 FEIS.

Response W-12

The effects of an oil spill on the marine mammals of the Sale 97 planning area and on the subsistence harvests of these mammals are addressed in the effects of oil spills parts of Sections IV.B.4, 5, and 9 of this EIS.

Response W-13

The comments of the NSB regarding the deferral areas are noted in their letter to MMS commenting on the Sale 97 DEIS; see Section V.B, letter number 8.

The Secretary of the Interior has the option of deferring from the Sale 97 proposed area any or all of the deferral areas analyzed in the FEIS or areas proposed after consultation with the Governor of Alaska, pursuant to Section 19 of the OCSLA, as amended.

Response W-14

The concern about employment is addressed in Section IV.B.10.a(2). Training of local residents for employment will be determined by the policies of the lessees and other institutions, such as the NSB government. It is commonly assumed that the lessees will pay their fair share for their use of any public facilities.

Response W-15

As noted in Section I.A.5, scoping meetings are held in some of the communities that might be affected by petroleum exploitation in the Beaufort Sea Planning Area. These meetings provide an opportunity for local residents to express their concerns and furnish information about local conditions.

Response W-16

It is assumed that onshore-development facilities will be contained in enclaves, which would limit the economic effects on NSB villages to NEGLIGIBLE. Search-and-rescue capabilities would be enhanced by the presence of such additional enclaves, which normally include good rescue capabilities and medical facilities.

Response W-17

The consequences of rapid growth in small communities is indeed a topic of concern. A description and analysis of these consequences are provided in the following sections of the Sale 97 DEIS:

III.C.2.c	Community Governance and Administration
IV.B.8.a(1)	Effects of Energy Development on Community Attitudes Towards Government
IV.B.8.a(2)	Effects of Offshore Oil Spills
IV.B.8.b(5)	Summary of Cumulative Effects of Onshore Development

VI

CONSULTATION AND COORDINATION

VI

VI. CONSULTATION AND COORDINATION

A. Development of the Proposal

The proposed Beaufort Sea Lease Sale 97 is one of 41 proposed OCS sales included in the 5-Year OCS Oil and Gas Leasing Schedule. Official coordination with other government agencies, industry, and the public regarding this proposal began in September 1983. At that time, MMS requested resource reports from all Federal agencies with expertise pertinent to the proposal and the proposed sale area. Next, on September 24, 1984, a Call for Information and Nominations and Notice of Intent to Prepare an EIS was issued, which requested expressions of industry interest in blocks within the Call area and requested comments on environmental issues related to possible oil and gas leasing in the area. Responses were received from six companies, the State of Alaska, the North Slope Borough, the Alaska Eskimo Whaling Commission, and the National Oceanic and Atmosphic Administration.

Following evaluation of the area nominations and environmental information received in the process described above, together with other relevant information, MMS submitted a recommendation for area selection to the Secretary. On January 22, 1985, the Department of the Interior announced the area selected for further environmental study. (See Sec. I.A for more details.)

B. Development of the EIS

During preparation of this EIS, Federal, State, and local agencies; industry; and the public have been consulted to obtain descriptive information, to identify significant effects and issues, and to identify effective mitigating measures and reasonable alternatives to the proposal. The information received has been considered in preparing the EIS. In addition, scoping meetings were held with Federal, State, and local agencies and the public to identify more clearly and specifically issues and alternatives to be studied in the DEIS. Scoping information can be found in Section I.D. Departmental agencies with interest and expertise in the OCS were consulted during the development of the potential mitigating measures for this proposal (see Sec. II.B.1.c).

C. List of Contacts for Preparation and Review of the Draft Environmental Impact Statement

Federal, state, and local government agencies; academic institutions; industry; special-interest groups; and private citizens were consulted prior to and during the preparation of this EIS. These agencies, institutions, groups, and individuals are listed below and were sent copies of the EIS for review and comment.

Federal

Legislative Branch

Senator Ted Stevens
Senator Frank H. Murkowski
Congressman Don Young

Executive Branch - Departments

- Department of Agriculture
  - Forest Service
- Department of Commerce
  - National Marine Fisheries Service
  - National Oceanic and Atmospheric Administration
- Department of Defense
  - Army Corps of Engineers
- Department of Energy
  - Federal Energy Regulatory Commission
- Department of the Interior
  - Advisory Council on Historic Preservation
  - Bureau of Indian Affairs
  - Bureau of Land Management
  - Bureau of Mines
  - Fish and Wildlife Service
  - Geological Survey
  - National Park Service
- Department of Transportation
  - Coast Guard

Independent Establishments

- Environmental Protection Agency

Boards, Committees, and Commissions

- Marine Mammal Commission

State of Alaska

- Office of the Governor
  - Division of Policy Development and Planning
  - Office of Coastal Management
- Office of the Lieutenant Governor
- Department of Administration
- Department of Commerce and Economic Development
- Department of Community and Regional Affairs
- Department of Education
- Department of Environmental Conservation
- Department of Fish and Game
- Department of Health and Social Services
- Department of Labor
- Department of Law
- Department of Natural Resources
  - Commissioner
  - Office of Research and Development-CZM Coordination
- Department of Revenue
- Department of Transportation and Public Facilities
- Legislature, Division of Public Information Services
- Alaska Historical Library
- Alaska Oil and Gas Conservation Commission
- Alaska State Library
- University of Alaska
  - Arctic Environmental Information and Data Center
  - Arctic Project Office
  - Institute of Marine Science
  - Institute of Social and Economic Research

Institute of Water Resources
Sea Grant Program

Local Government and Native Organizations

Alaska Eskimo Whaling Commission
Alaska Federation of Natives
Alaska Legal Services Corporation
Alaska Native Foundation
ANILCA Section 805 Regional Councils
- Arctic Regional Council
- Interior Regional Council
- Southcentral Regional Council
- Southeast Regional Council
- Western Regional Council

ANILCA Section 805 Local Advisory Committees (Arctic Region)
- Eastern Arctic Advisory Committee
- Kotzebue Advisory Committee
- Lower Kobuk Advisory Committee
- Noatak/Kivalina Advisory Committee
- Northern Seward Peninsula Advisory Committee
- Norton Sound Advisory Committee
- Southern Norton Sound Advisory Committee
- St Lawrence Island Advisory Committee
- Upper Kobuk Advisory Committee
- Western Arctic Advisory Committee
- Arctic Slope Corporation

Arctic Slope Native Association
Arctic Slope Regional Corporation
Atkasook Corporation
Barrow City Manager
Bristol Bay Native Corporation
Calista Corporation
Cully Corporation
Doyon Limited
Inupiat Community of the Arctic Slope
Kaktovik Inupiat Corporation
Kuukpik Corporation
Manilaq Association
Mayor of Barrow
Mayor of North Slope Borough
Mayor of Kaktovik
Mayor of Nuiqsut
Mayor of Point Hope
Mayor of Wainwright
Municipality of Anchorage
North Pacific Rim
North Slope Borough
North Star Borough Library
Northwest Alaska Native Association
Nunamuit Corporation
Olgoonik Corporation
Tigara Corporation
Ukpeagvik Inupiat Corporation

Special-Interest Groups

Petroleum Industry

ABSORB
Alaska Oil and Gas Association
Amerada Hess Corporation
American Petroleum Institute
Amoco Production Company
Arco Alaska, Incorporated
Atlantic Richfield Company
BP Alaska Exploration, Incorporated
Canadian Occidental Petroleum, Ltd.
Canadian Superior Oil Limited
CANSO Oil and Gas, Incorporated
Champlin Petroleum Company
Chevron USA Incorporated
Cities Service Oil Company
Conoco Incorporated
Dome Petroleum Limited
Diamond Shamrock Corporation
Dillingham Maritime
Esso Resources Canada, Limited
Exxon Company, USA
Geophysical Services, Inc.
Getty Oil Company
Gulf Oil Exploration and Production Company
Hunt Oil Company
Husky Oil Company
Idemitsu Alaska Oil Development Corporation
Imco Services
Marathon Oil Company
Mobil Exploration and Production Services
Mobil Oil Company
Murphy Oil Corporation
National Ocean Industries Association
Occidental Petroleum
Ogle Petroleum Incorporated
Oil and Gas Journal
Pan Canadian Petroleum Company
Parker Drilling Company
Pennzoil Company
Phillips Petroleum Company
Resource Development Council
Shell Oil Company
Sohio Alaska Petroleum Company
Sun Exploration and Production Company
Superior Oil Company
Tenneco Oil
Texaco Incorporated
Union Oil Company of California
Zapata Offshore Company

Other Groups

- Acoustical Society of America
- Alaska Center for the Environment
- Alaska Conservation Society
- Alaska Fisherman's Union
- Alaska Professional Hunters Association
- Alaska Public Interest Research Group
- Alaska Wildlife Federation and Sportman's Council
- American Cetacean Society
- Audubon Society
- Center for Action on Endangered Species
- Chugach Gem and Mineral Society
- Committee for Better Environment
- Environmental Defense Fund
- Environmental Services Ltd.
- Fairbanks Environmental Center
- Friends of the Earth
- Greenpeace Alaska
- Isaac Walton League of America
- Natural Resources Defense Council
- Northern Rim Resource Management Council
- North Pacific Fisheries Management Council
- Rural-CAP, Incorporated
- Sierra Club
- Southeast Alaska Conservation Council, Incorporated
- Trustees for Alaska
- Whale Center
- Yukon Conservation Society

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Errata

The following changes to citations in the text should be made to maintain consistency between text citations and bibliography references.

Section IV-A

Figure IV-9 -- Change Samuels et al., 1983, to Samuels, Banks, and Hopkins, 1983.

Section IV-L

Page IV-L-7 -- Change USDOI, MMS, 1985 (two citations), to USDOI, MMS, 1985d.

Section V

Page V-46, Response 7-5 -- Change Allen et al. (1984) to Allen, Hale, and Prentki (1984).

Page V-94, Response 21-11 -- Change USDOI, MMS, 1985, to USDOI, MMS, 1985a.

Page V-97, Response 21-27 -- Change Richardson et al. (1985a) to Richardson, Wells, and Wursig (1985).

Page V-101, Response 21-55 -- Change MMS, Alaska OCS Region, 1987, to USDOI, MMS, Alaska OCS Region, 1987.

Page V-126, Responses B-47 and B-49 -- Change Richardson et al., 1985a, to Richardson, Wells, and Wursig, 1985.

Appendix B

Page B-1 -- Change NSB, 1983, to NSB, 1983a.

Page B-2 -- Change Maynard and Partch et al., 1985, to Maynard and Partch, Dames and Moore, and Stephen Braund and Associates, 1985.

Page B-5 -- Change OGJ, 1985, to OGJ, 1985c.

Page B-6 -- See change for Page B-2.

Page B-9 -- Change Dome Petroleum Limited et al. (1982) to Dome, Esso, and Gulf (1982). Change USDOI, MMS, 1984, to USDOI, MMS, 1984a.

Page B-10 -- Change OGJ, 1985, to OGJ, 1985b.

APPENDICES

A

APPENDIX A

ALTERNATIVE-ENERGY SOURCES AS AN ALTERNATIVE TO THE OCS PROGRAM

ALTERNATIVE-ENERGY SOURCES AS AN ALTERNATIVE TO THE OCS PROGRAM

A. Introduction

The oil and gas that could become available from the proposal could add to National domestic production. To delay or eliminate the proposed sale in part or in whole would reduce future OCS oil and gas production, necessitate escalated imports of oil and gas, and/or require the development of alternative-energy sources to replace the energy resources expected to be recovered if the proposed sale took place.

If the proposed sale were canceled, an additive effect of greater oil and gas deficits could be expected to result in increased imports; and the following energy actions or sources might be used as substitutes. (Some of these actions are not feasible at this time and may not be feasible during the estimated production life of the Beaufort Sea Planning Area.)

Imported Oil and Gas	See Section B of this appendix
Coal	See Section C
Coal Conversion to Synthetic Fuels	See Section D
Oil-Shale Conversion to Synthetic Fuels	See Section E
Biomass Conversion to Synthetic Fuels	See Section F
Domestic Onshore Oil and Gas	See Section G
Geothermal Power	See Section H
Solar Power	See Section I
Wind-Turbine Power	See Section J
Hydroelectric Power	See Section K
Nuclear Power	See Section L
Conservation	See Section M

This appendix briefly discusses these alternatives. For more detailed information on each of these energy sources and their respective environmental effects, refer to "Energy Alternatives: A Comparative Analysis" (University of Oklahoma, 1975), prepared for the Bureau of Land Management by the Science and Public Policy Program of the University of Oklahoma and the Proposed 5-Year Outer Continental Shelf Oil and Gas Leasing Program, Mid-1987 to Mid-1992 (USDOI, MMS, 1987).

B. Imported Oil and Gas

1. Background Considerations

Spurred by new discoveries and competition, Middle East oil production expanded in the 1950's and 1960's. New markets were opened and prices softened. Between 1948 and 1972, the real price of oil fell. U.S. consumption of oil simultaneously increased while production remained constant; imports were relied upon to make up the difference.

Two major shocks to the world oil market focused public attention on oil-supply issues. The 1973-1974 Arab oil embargo cut off Middle Eastern oil sources from unrestricted trade in world oil markets and resulted in escalation of oil prices from a pre-embargo world price of $7.74 per barrel in 1970

to a postembargo price of $24.40 in 1975. The world oil market received its second major jolt during the 1979-1980 Iranian revolution, which once again reduced oil-supply levels and accelerated prices to a 1980 world price of $42.36 per barrel.

In response to these events, the U.S. and the rest of the world instituted a wide variety of measures to conserve energy and to find alternative sources of supply. The results of these efforts to reduce imports generally have been successful. The underlying market structure for energy has been altered. World demand for oil peaked in 1977 and appears to be in a structural decline. Gross national products have been rising along with nonenergy output, alternative-energy sources, and non-OPEC (Organization of Petroleum Exporting Countries) production. The overall success for these measures was reflected by the 1984 decline in the world oil price to about $29.00 per barrel.

The inability of the OPEC to secure the cooperation of its members to reduce production and halt this price slide contributed to decisions by certain OPEC members to substantially increase production. During 1986, the combination of lower demand--initially brought about as a response to high OPEC pricing--and the decisions to increase rates of production resulted in very rapid declines in oil prices to levels that were inconceivable only months eariler. During 1986, world oil prices on the spot markets also frequently fell to levels well below $10.00 per barrel; by year's end, prices had increased modestly to approximately $15.00 per barrel.

2. Environmental Effects

The primary hazard to the environment from increased oil and gas imports is the possibility of oil spills, which can result from intentional or accidental (tanker casualties) discharges. For a more detailed discussion of the environmental effects from oil spills, see Section IV.A of this EIS.

Intentional discharges would result largely from uncontrolled deballasting of tankers. The effects of this chronic, low-level pollution are largely unknown. The worldwide tanker-casualty analysis indicates that, overall, an insignificant amount of the total volume of transported oil is spilled due to tanker accidents. However, a single incident--such as the breakup of the Torrey Canyon in 1967 or the Amoco Cadiz in 1978--can have disastrous results. Further, even relatively small spills from tankering of imported oil can have major effects on sensitive coastal environments. For example, in less than one year, two spills occurred off San Francisco and generated serious effects on marine and coastal birds around the Farallon Islands National Marine Sanctuary and up and down the coast of California. Over 2,000 seabirds were killed by the Puerto Rican tanker spill, which contacted the Farallon Islands.

The assessment of cumulative effects in the Proposed 5-Year OCS Leasing Program (USDOI, MMS, 1987) includes the estimated mean number of oil spills associated with importing oil and refined products via tanker. The assumed frequency of tanker spills greater than 1,000 barrels was 1.3 spills per billion barrels transported. Further, only one-half of the 1.3 spills per billion barrels was assumed to occur in U.S. waters. The estimated most likely number of large oil spills from tankering of imported oil used in the cumulative case--based on estimated imports over a 30-year period--was equal to 61 spills of 1,000 barrels or greater. This compares with an estimated

most likely number of 157 spills from all sources (all past and future OCS leasing, all domestic and import tankering). Thus, oil spills associated with imports represent nearly 40 percent of all oil spills greater than 1,000 barrels over the 30-year period used in the assessment of cumulative effects.

3. Conclusions

Major oil spills from tankers could result in the most significant environmental effect associated with the use of imported oil. Additional major environmental concerns include effects from tanker spills that occur in sensitive areas that are otherwise protected from oil spills, e.g., the Farallon Islands; air-quality effects associated with tanker unloadings; and increased vessel traffic and port congestion.

C. Coal

1. Background Considerations

Coal is a combustible rock that contains more than 50 percent by weight and 70 percent by volume of carbonaceous material from the accumulation, and physical and chemical alteration, of vegetation. Classification of coal is based on chemical analysis and certain physical reactions that measure the progressive response of coal to heat and/or pressure. The analysis involves the determination of four constituents: (1) moisture, (2) mineral impurity (ash), (3) volatile material (gas/vapor), and (4) fixed carbon (solid residue after removal of the gases). Based upon these constituents, coal is ranked from low-ranked lignite through subbituminous and bituminous coal to high-ranked anthracite and meta-anthracite. Ninety-seven percent of the U.S. coal reserves are either bituminous (66%) or subbituminous (31%), with the remaining coal being anthracite.

Most of the bituminous coal produced in the U.S. is burned to obtain thermal energy for generating electricity, processing raw or manufactured material, and heating industrial complexes (see Tables A-1 and A-2). Other uses include gasification and liquefaction (see Secs. C.1 and C.2 of this appendix).

The total demonstrated U.S. reserve base is about 488 billion tons (Table A-3). The Federal Government manages about 60 percent of the coal resources within Colorado, Montana, New Mexico, North Dakota, Utah, and Wyoming. At the close of Fiscal Year 1983, 18 competitive and noncompetitive coal leases were issued covering 22,108 acres. As of September 30, 1982, 691 coal leases covering 1,288,310 acres were active (USDOI, 1984).

Coal showed a slight recovery in 1984 and 1985 after a series of setbacks due to the recession and the falling export market (Table A-2). Coal usage indicated an increase of coal consumption, particularly by the utilities and steel industries (Table A-1). Coal consumption was 791.3 million tons in 1984 and 818.6 million tons in 1985, and coal production was 898.9 million tons in 1984 and 886.1 million tons in 1985.

2. Environmental Effects

Numerous environmental effects can result from the mining and combustion of coal--land-disturbance effects of mining; reclamation procedures; acid-mine-

Table A-1
Coal Consumption by End-Use Sector
(million short tons)

Year	Electric Utilities	Coke Plants	Other Industrial	Residential and Commercial
1980	569.3	66.7	60.3	6.5
1981	596.8	61.0	67.4	7.4
1982	593.7	40.9	64.1	8.2
1983	625.2	37.0	66.0	8.4
1984	664.4	44.0	73.7	9.1
1985(a)	693.5	40.9	76.3	7.9

Source: Energy Information Administration, Annual Energy Review 1985, (a) Preliminary.

Table A-2
Coal Overview
(million short tons)

Year	Production	Consumption	Imports	Exports
1980	829.7	702.7	1.2	91.7
1981	823.8	732.6	1.0	112.5
1982	838.1	706.9	0.7	106.3
1983	784.9	736.7	1.3	77.8
1984	895.9	791.3	1.3	81.5
1985(a)	886.1	818.6	2.0	92.7

Source: Energy Information Administration, Annual Energy Review 1985, (a) Preliminary.

Table A-3
Demonstrated Reserve Base of the Major Coal Provinces in the United States

Demonstrated reserves
(in millions of tons)

Province	Underground	Surface	Total
Appalachian	97,000	19,200	116,900
Interior	94,000	41,400	135,400
Western	140,900	95,200	236,000
	331,900	155,800	488,300

Source: Energy Information Administration, Annual Energy Review 1985.

drainage problems; problems of air pollution, including the local and global effects of sulfur oxides and carbon-dioxide emissions; and problems associated with transportation. While existing environmental problems related to the present coal-fuel cycle are likely to increase in scale, additional problems are likely to arise as new coal-gasification and -liquefaction plants begin operating. These new plants may be needed to offset the shortfall in availability of existing fuels if OCS oil and gas is reduced through delay or elimination, in part or whole, of the proposed OCS leasing program.

Coal can be mined by two methods--surface mining and underground mining. Surface-minable coal accounts for about 32 percent of the demonstrated coal reserves in the U.S. (Table A-3). Surface mining can result in effects on air, land, and water by creating conditions that promote water and wind erosion, destruction of topsoil, elimination of vegetation, and contamination of soil and water from weathering of toxic strata.

According to Federal Office of Surface Mining Final EIS (1980), surface mining of coal completely eliminates existing vegetation, destroys the genetic soil profile, displaces or destroys wildlife and wildlife habitat, degrades air quality in the area, alters the current land uses, and--to some extent--changes the general topography of the area being mined. Without diligent reclamation, surface-mined lands are often unsuitable for other uses.

The Department of Energy (DOE) Environmental Development Plan on Coal Extraction and Preparation (USDOE, 1979) reports significant water-quality degradation from former mining sites, with severe effects on aquatic ecosystems. Streams and reservoirs (primarily in the eastern U.S.) have been affected by sedimentation from surface mines, acid-mine drainage, and erosion of spoil piles from mining and coal cleaning and preparation.

Surface-mining effects on ground water include: (1) drainage of usable water from shallow aquifers, (2) lowering of the water table in adjacent areas and changes in flow direction within aquifers, (3) contamination of aquifers below mine operations from leakage of mine waters, and (4) increased infiltration of precipitation on spoil piles. The improper removal of overburden can cause the loss of topsoil and exposure of the parent material, and can create vast wastelands. The stockpiling of topsoil from the area can destroy or alter many of the natural soil characteristics.

Surface mining of coal causes indirect and direct effects on wildlife that come primarily from the removal and redistribution of the land surface. The area being surface mined (open pit) and the associated stockpiles are not capable of providing food or cover for wildlife. Without proper rehabilitation, the area must go through a weathering period and may require a few years to several decades before vegetation is re-established. Broad and long-lasting effects on wildlife within the area can occur from this alteration of the habitat.

Mechanical cleaning of coal also causes effects on land use. Although the amount of land required for disposal of coal-cleaning wastes varies with coal-extraction techniques and characteristics, National estimates range from 0.3 to 0.9 acres used per million tons of coal cleaned.

Underground mining of coal has the potential to result in subsidence, dropping of the water table, or interception of surface-water drainages. Subsidence is probable in most underground coal mining. Depending upon the degree of extraction, subsidence occurs immediately or at some future time. Subsidence may disrupt aquifers, damage surface facilities, and trigger mud slides or rock falls. In some cases, subsidence can lead to permanent loss of coal resources.

The health and safety of mine workers are major concerns associated with both surface and underground mining. Safety and health hazards to the workers, especially in underground mining, are the highest of any industry. Additional discussion on effects associated with coal development can be found in the Final EIS on the Proposed Federal Coal Leasing Program (USDOI, 1974).

Coal is transported by rail, truck, water, slurry pipeline, or conveyor belt. The environmental effects of coal transport occur during loading, while enroute, and during unloading. All forms of coal transport exhibit common environmental-effect factors. All forms use land for terminal/handling plants or for railroad installations or pipeline throughways. Rail transport and trucks cause damage to buildings, and trucking causes major structural damage to highways. Air pollutants and noise are emitted from engines powering the transportation facility. The transport of coal necessarily involves fugitive dust emission, which further affects the air quality.

Combustion of coal results in the emission of carbon dioxide, sulfur oxides, and nitrogen oxides, which contribute to the problems of acid rain and potential climatic warming (greenhouse effect). Acid rain is being recognized as a major environmental concern that adversely affects aquatic and terrestrial ecosystems. Many uncombusted or partially combusted carbon compounds, including known or potential mutagens and carcinogens such as polycyclic aromatic hydrocarbons are also emitted during coal combustion. These carbon-compound emissions are cause for ecological and human-health concerns.

3. Conclusions

The major environmental effects of expanding coal production include disruption of large areas of land surface with surface mines, additional acid-mine-drainage problems, and the greater air-quality effects associated with burning coal rather than natural gas or oil in power plants.

D. Coal Conversion to Synthetic Fuels

1. Background Considerations

Synthetic-fuel development has slowed down due to the sagging price of crude oil that resulted from a world surplus. Oil-price moderation, soaring costs, and lack of Federal assistance have led operators throughout the U.S, to shelve, delay, or abandon commercial synfuel ventures. Some operators have kept their projects in order to alleviate future depression of fossil fuels.

Coal can be converted to synthetic fuel by either gasification (synthetic gas) or liquefaction (synthetic liquid). These processes involve the breaking, or "cracking," of heavy hydrocarbon molecules into lighter molecules and the simultaneous enrichment of the molecules with hydrogen.

Water is required in both processes as a source of hydrogen and for other process steps (e.g., removing sulfur compounds and as a cooling component). In general, lower-quality coals (lignitic, subbituminous, and bituminous) are more efficiently converted to synthetic fuels than anthracite (Rickert and Ulman, 1979).

a. Coal Gasification

The coal-gasification process uses coal to produce gaseous fuel products that can be directly combusted in a boiler, used as chemical feedstock, or used as a product that can be converted into liquid fuels (see Sec. D.1.b of this appendix).

Three ingredients are required to chemically synthesize gas from coal--carbon, hydrogen, and oxygen. The synthesis is performed by reacting coal under sufficient heat with steam and air. Depending on combustion (air vs. pure oxygen), the gas produced is either a low-Btu (100-200 Btu's standard ft^3) or medium-Btu (300-650 Btu's) gas. The medium-Btu gas can be further processed by methanation to produce high-Btu (950-1,050 Btu's) gas (Bentz and Salmon, 1981).

Several types of gasifiers are commercially available for the production of low and medium Btu gas (Koppers - Tetzek, Winkler, and Lurgi). A detailed discussion on the chemical and design considerations, as well as a process description, can be found in "Environmental, Health, and Control Aspects of Coal Conversion: An Information Overview" (Braunstein and Copenhasier, 1977).

Coal gasification seems to be the leading commercial-scale synfuel project throughout the world. In the U.S., only 30 coal-to-synthetic-fuel projects were in operation in 1981. Of these, only 8 are commercial operations. The remainder are demonstration/pilot plants or process-development plants.

The state-of-the-art gasifier available for use in gasification of the highly caking eastern bituminous coal and other coals is an atmospheric Koppers-Totzek unit. The most advanced gasifier is the pressurized Texaco gasifier.

b. Gas Liquefaction

Coal can be liquefied by both direct and indirect processes. Indirect-liquefaction processes convert coal to liquid products by first gasifying coal to a mixture of carbon monoxide and hydrogen (synthetic gas) and then allowing these gases to react in the presence of a catalyst to form liquid products. In the direct-liquefaction process, a coal slurry is reacted directly with hydrogen in the presence of a catalyst, thus eliminating the step involving the indirect-liquefaction process. After hydrogeneration, the solids and liquids are separated. The residual solids are then burned in a gasifier to generate hydrogen and steam. The quality of the liquid can be either a boiler-fuel grade or a synthetic-crude grade.

The Fisher-Tropsch process, which converts synthetic gas to a liquid product, has been operating in South Africa's Sasol plants using a commercial gasifier (Lurgi). These facilities convert coal mined onsite into 27 different fuel and chemical products. The combined coal consumption of all three plants will be about 33 million metric tons per year. It is predicted that Sasol, Ltd., could produce sufficient quantities of hydrocarbon to make South Africa self-sufficient (Engineering and Mining Journal, November 1982). Four major direct-liquefaction processes are under development: Solvent Refined Coal (SRC) I and II, H-Coal, and Donor Solvent.

2. Environmental Effects

The major potential environmental, health, and socioeconomic problems related to coal conversion are terrestrial, air- and water-quality effects resulting from discharged effluents, air emissions, and solid-waste disposal associated with mining, transportation, and processing of the coal. (See Sec. C of this appendix for a discussion of the effects associated with the mining of coal to supply coal-gasification or liquefaction plants.)

In its EIS on Synthetic Fuels and the Environment - An Environmental and Regulatory Impact Analysis (USDOE, 1980), the DOE reports that substantial quantities of solid-waste material will be generated in each stage of the coal-conversion process. Waste material will be generated directly from the process that is part of the original feed, such as ash, unreacted carbon in the form of chars and tars, and fly ash from auxiliary boilers. Secondary wastes consist of added materials/chemicals, such as catalysts or coal conditioners, lime from scrubbers, and added reactants from water treatment.

There is concern for the health and safety of workers since many hazardous and toxic substances are formed and used in the synfuel process. Many substances are identified carcinogenic materials that can form in coal conversion, e.g., benzo(A)pyrene, dibenz(a,h)anthracene, chrysene, and 7-methylbenz(c)-acridine as well as aromatic amines (e.g., naphthylamine and benzidine) (USDOE, 1980).

Air-quality emissions from coal-conversion facilities can include sulfur oxides, particulate matter, nitrogen oxides, hydrocarbons, hydrogen sulfides, ammonia, hydrogen cyanide, polynuclear aromatic hydrocarbons, nitrogen and sulfur containing heterocyclic compounds, and trace elements. The appropriate use of existing available technology should control source emissions to levels in compliance with applicable current regulations.

Wastewater will result from numerous sources within the process. Standard treatment systems using flocculation and biodigestion should prevent water-quality problems.

3. Conclusions

The major environmental effects of expanding the use of coal in synthetic-fuel production include air-quality effects generated by synthetic-fuel plants, wastewater generated in the production of synthetic fuels, and concerns for the health and safety of workers in synthetic-fuel plants.

E. Oil-Shale Conversion to Synthetic Fuels

1. Background Considerations

The production of synthetic fuels from oil shale provides an alternative-energy source. Oil shale is a fine-grained, sedimentary rock containing material called kerogen. Kerogen is of high molecular weight and has low solubility in any solvent. The only practical method of recovering hydrocarbons from the oil shale is by heating the rock to high temperatures (approximately 500°C) and thereby recovering shale oil and hydrocarbon gases--a process known as retorting. The retorting of oil shale can be achieved by (1) surface retorting, (2) in situ retorting, and (3) modified in situ retorting.

There are two methods for surface retorting of oil shale--the direct- and indirect-heat methods. In both cases, heat is required to bring about pyrolysis of the raw shale. In the direct-heated process, the heat is supplied by the creation of a combustion zone within the retort. In the indirect-heated processes, gases are circulated to an external reactor for combustion. Heat is transferred back to the retort by recirculating gases or solids through the retort and the external reactor.

In situ retorting refers to a process of retorting the shale in place, without the removal of any material. This eliminates the disposal problem associated with surface processing. In this process, the oil shale is fractured underground, after which heat is introduced to liquefy the kerogen. The produced oil is then removed through wells, utilizing natural permeability.

The modified in situ oil-shale process involves mining or removing up to 30 percent of the shale from the retort zone so that void volume is created and permeability is increased. The remaining oil shale in the retort is then explosively fractured and retorted in place. In the case of leached shale, the shale is not fractured; hot gas is injected as the retorting medium. Retorting can then be accomplished by moving the retorted oil either horizontally or vertically.

After retorting, the raw shale oil is processed to remove water and other contaminants by a separation system that typically consists of a closed-cycle processing unit, such as impingement or centrifugal separators, or mechanical demisters. The principal functions of the system are separation and recovery of oil or gaseous products from contaminants that include water produced in the retorting process as well as particulate material carried over the retort.

Following product recovery, crude shale oil requires further treatment to remove nitrogen, oxygen, and sulfur compounds and to reduce viscosity and pour points to allow pipeline or tanker transport. Removal of the nitrogen compounds requires a special refinery process.

Large areas of the western U.S. are known to contain oil-shale deposits; those in the Green River Formation in Colorado, Wyoming, and Utah have the greatest commercial potential. The oil-shale resources of the Green River Formation are estimated at 54 billion barrels of recoverable oil with an assay of 30 gallons per ton, and 600 billion barrels of reserves in place from shale with an assay exceeding 25 gallons per ton. Therefore, the Green River Formation represents 20 to 30 times the known reserves of conventional crude oil in the U.S.

Development in the U.S. shale industry is concentrated in Colorado's Piceance Basin, where approximately 85 percent of the western high-grade deposits are found (Rickert and Ulman, 1979). The oil-shale projects, in some cases, are funded or underwritten by the DOE. Several of the projects are experiencing

the effects of soaring costs, sagging oil prices, and delayed development. Many of the companies are extending their timetables and reducing production goals.

In the eastern U.S., the shale deposits underlie Indiana, Ohio, Illinois, Kentucky, Tennessee, Michigan, and Pennsylvania. The eastern shales are of a lower quality than the western shales, but the deposits are more extensive. The eastern shale has a poor carbon-hydrogen ratio and is therefore required to be retorted in the presence of hydrogen. In contrast, the western shale requires only the application of heat to release the oil.

There is an estimated 1 trillion barrels of recoverable reserves within U.S. deposits. The 1-trillion-barrel figure is based on hydrogen retorting rather than on Fischer assay (International Petroleum Encyclopedia, 1982).

2. Environmental Effects

The conversion of oil shale to synthetic fuels will have effects on air, land, and water quality. These effects are related to various air emissions, effluent discharges, and solid-waste disposal (spent shale from surface retorting).

Air-quality concerns relate to (1) the production of both criteria pollutants and (2) particulate matter and noncriteria pollutants associated with dust from mining and crushing of raw shale, and resuspension of disposed spent shale.

Control of particulates resulting from the production of oil shale can be a problem. For large surfaces at the mine, "wetting" or vegetation of the stock piles is an adequate control, whereas for more limited areas (e.g., conveyors and crushers), baghouse filters, scrubbers, and cyclones are used to control particulate emissions. Fugitive emissions due to traffic and wind are a potential problem and may require the use of chemical additives and best control-management practices.

Sulfur in raw-oil shale amounts to about 0.7 percent by weight, either as organic sulfur or associated with iron pyrite. During retorting, about 40 percent of the organic sulfur in shale appears as H_2S in the produced gases; and the other 60 percent appears as heavier sulfur compounds in the raw shale oil, spent shale, or water residuals. If shale oil or low-Btu gas from the retort is used for steam generation or any other combustion process, sulfur oxides will be formed and flue-gas-desulfurization scrubbers will need to be used for tail-gas cleanup.

The kerogen fraction of the raw shale can contain up to 2 percent of nitrogen. The extent of NO_x formation from the use of retort off-gases or shale oil to hear the retort will be related to flame-temperature-residence time and the air/fuel mixture. Combustion efficiency during oil-shale retorting is not expected to be a significant problem. HC and CO emissions will therefore be small. The low-Btu gas formed during retorting will either be flared or used for onsite steam production with traditional flue-gas-cleanup controls.

Water-resource effects encompass effluent control and water-supply issues. In the semiarid Piceance and Uinta geological basins in Colorado and Utah, where

most of the high-quality-oil-shale resource is found, water pumped from mines or drawn for process use is expected to be recycled or consumed. Effluent problems are focused on potential contamination of aquifers and surface waters by leaching from spent-shale piles, evaporative and lagoon concentrates, or burned-out in situ retorts, rather than from direct emissions. Problems with in situ processes concerning backflood water and fugitive-gas emissions may result in contamination of ground-water aquifers. Ground-water supplies and surface-water supplies fed by ground-water aquifers might be affected for very long periods of time, thereby creating difficulties in securing adequate water supplies for retort operation.

Wastewater from surface-retorting operations (up to 8 gallons/ton of input shale and more from some in situ operations) and process water from product-upgrading operations will have to be controlled. Wastewater can then be used for moisturizing spent shale. Under current planning, oil-shale developers envision zero discharge of their wastewaters.

Disposal of spent shale and storage of raw shale could create land disturbances of large magnitude, potential accumulation of toxic substances in vegetation, and contamination of ground waters and surface waters from runoff.

The DOE (1980) reports that retorted shale contains varying amounts of organic and inorganic residuals depending on the retorting process. It presents a major solid-waste-management and disposal problem for the surface and modified in situ operations from both the amount and its content. Retorted shale will have a density of about 75 to 100 pounds per cubic foot after compaction. This means that for every 50,000 barrels of surface-retorted shale oil produced, there will be enough spent shale to occupy a volume of almost 2 million cubic feet, or about a 2-foot depth over a square mile for every month of operation.

Above-ground-retorted shale from modified in situ operations would have considerably less solid waste for disposal. Large areas are required for the storage of raw shale and the disposal of retorted shale. The resulting potential loss of habitat for plant and animal communities and natural erosion of the disposal piles by wind and water may not be fully mitigated by vegetating or physically stabilizing the disposal piles. Problems and uncertainties related to the vegetation of retorted shale include water requirements, accumulation of toxic trace substances in the vegetation, and long-term stability.

Potential problems with stability of waste piles will require several years to emerge, and uncertainties will remain for 10 to 20 years. Spent shale can either be returned to the mine or stockpiled above, in which case it will be compacted and vegetated or otherwise stabilized to prevent erosion by wind or water. Dust control will be accomplished by application of water or chemical wetting agents. Surface-disposal options include filling valleys and recontouring surfaces. The major consideration is to ensure that the large quantities of spent shale can be economically disposed of with minimum environmental damage.

The occupational work force will be exposed to an environment largely uncharacterized in terms of industrial hygiene and safety analyses. The miners will be subject to exposure to possible toxic materials.

3. Conclusions

The major environmental effects of oil-shale development include: effects from disposal of spent shale, air-quality effects from dust and vehicle emissions, disruption of land, the large quantities of water needed in processing, and water-quality effects from wastewater disposal.

F. Biomass Conversion to Synthetic Fuels

1. Background Considerations

Biomass conversion is the process of transforming biomass (organic material) into usable energy sources. This conversion transforms the biomass into (1) liquid form (alcohol) or (2) methane gas.

A biomass-fueled gasification project that will convert peach pits into gas is planned for a greenhouse in Lodi, California. This is the first commercial application of an automated, small-scale, biomass-fueled gasifier in California (California Energy Commission, 1984). The gas produced will be used to supply heat to greenhouses. The system will result in a substantially reduced energy cost compared with the existing natural gas system. As a result, the growers will be able to expand their growing seasons, increase plant yield, and expand their market to include high-energy plants.

a. Ethanol and Methanol

Ethanol from grain is one of the alternative fuels that can be produced from a renewable resource. Ethanol can partially replace current transportation fuels derived from petroleum. Although ethanol can be produced from grain, 70 percent of the high-proof ethanol is made synthetically from ethylene gas derived from petroleum (USDOE, 1980).

Ethanol may also be derived from any carbohydrate source, such as starch in corn and other grains. The DOE (1980) reports that nearly 12 billion gallons of ethanol would be required to produce a National 10-percent alcohol/gasoline blend by the year 2000. Assuming an average yield of 100 bushels per acre and an ethanol yield of 2.5 gallons per bushel, this amount of alcohol would require 48 million additional acres of corn production.

Methanol production is based upon the gasification of wood to produce a medium-Btu gas followed by a chemical reaction to combine water and carbon monoxide to form hydrogen and carbon dioxide (see Sec. C of this appendix). Additional carbon monoxide is combined catalytically with hydrogen to produce methanol.

Forest residue--"slash" cuttings left behind after conventional logging, and stump/root systems--can be used to generate methanol. A recent assessment estimated that forest-industry waste (lumber and pulp mills) could serve as the major resource for methanol production.

b. Organic (Urban) Waste

The basic processes for converting urban waste to energy are combustion, pyrolysis, and bioconversion. Each process requires waste collection and transportation. Some processes require mechanical preprocessing to separate the municipal solid waste into a refuse-derived fuel and other noncombustible and nonbiodegradable materials. Some of the noncombustible and nonbiodegradable materials such as ferrous metal, aluminum, and glass are recyclable.

Combustion of urban wastes in waterfall boilers is the most developed process, with eight plants commercially operating in U.S. cities. Urban-waste furnaces are being demonstrated at a facility processing 600 tons per day in Milwaukee, Wisconsin; and a 200-ton-per-day unit has been undergoing tests (joint Environmental Protection Agency [EPA] and DOE sponsorship) with 50-percent refuse-derived fuels at Ames, Iowa, since 1974.

Pyrolysis or thermal-gasification processes have been tested in Charleston, West Virginia; Baltimore, Maryland; and El Cajon, California. Municipal solid waste is decomposed in an oxygen-deficient atmosphere to produce combustible gas and liquids. Scrubbing is used to remove hydrochloric acid, hydrogen sulfide, and SO_2. Wastewater is a byproduct that requires treatment.

The bioconversion process for converting solid and liquid urban wastes into methane is in the research and early pilot-plant stages. The processes leave a waste-disposal problem in the form of liquid-digester residues, micro-organisms, and inorganic nonbiodegradable material. A DOE-sponsored digestion plant at Pompano Beach, Florida, and the ANFLOW project are currently producing methane.

2. Environmental Effects

Biomass conversion to synthetic fuels, and its residual wastes, will have effects on water and air quality and on the land (erosion and nitrogen depletion of the soil). Additionally, the general public may be exposed to aesthetic problems--dust, noise, and odor.

Following is a description of the adverse effects on the ecosystem from biomass conversion.

a. Ethanol and Methanol

Growing corn for ethanol production requires large amounts of nitrogen. In order to prevent nitrogen loss in the soil, rotation of crops with legumes or the use of anhydrous ammonia would be required. The runoff and leaching of pesticides and fertilizers would accompany increased grain cultivation. This can have an adverse effect on the ecosystem and possibly on humans.

The loss of sediments due to erosion, as well as the leaching of salts, could cause a wide variety of effects on ecosystems and could cause a reduction in land productivity.

Extensive production of methanol from silviculture-biomass resources may disturb up to 50 percent (350 million acres) of current forest land. In addition to pollution effects, methanol production has the potential to cause severe ecosystem effects, such as the elimination of the range of certain species, elimination of threatened and endangered species, and elimination of specific ecotypes.

Silviculture-biomass production and residue-removal schemes have the potential to significantly increase air and water erosion of the soil. Erosion of the soil from cleared areas is fairly predictable and can be serious in areas of high rainfall and hilly topography.

Silviculture for methanol production should not contribute to air pollution as dusting does to farming. For a plant that would process 2,000 tons per day of green wood and produce 170,000 gallons per day of methanol, it has been estimated that 1,000 tons per day of CO_2 would be vented into the atmosphere (USDOE, 1980).

With the generation of methanol from wood using an estimate of 0.25-percent product loss to the air, 1.4 tons per day of hydrocarbons are estimated. The facility would also generate 0.44 ton per day of particulate emission from the grinding room. When grain starch is converted to alcohol by means of hydrolysis and fermentation, approximately equal weights of ethanol and carbon dioxide are formed in the process.

Residual wastes (solids remaining after the fermentation process) have been estimated for a 20-million-gallon-per-day ethanol plant. The amount of raw waste might range from approximately 12 to 55 gallons per gallon of product. The waste may contain contaminants equivalent to 0.12 to 0.17 pound of (5-day biochemical oxygen demand/gallon of ethanol product).

Approximately 0.5 pound of excess activated sludge can be expected for each pound of BOD_5 removed. Assuming that the raw waste contains 0.17 pound of BOD_5 per gallon of product ethanol, 95-percent removal corresponds to 961 tons of BOD_5 removed per 1,012 Btu's produced. Excess waste will amount to 480 tons per 1,012 Btu's.

For a 170,000-gallon-per-day methane plant with activated-sludge treatment, it has been estimated that 0.64 ton per day of BOD_5 would be produced along with 6 tons per day of waste-activated solids and 25 tons per day of ash and unburned carbon.

b. Organic (Urban) Waste

Waste-conversion processes greatly reduce municipal solid-waste volume but still leave waste residuals that go into landfills or impoundments. The chemical composition and source (domestic, industrial) of the municipal solid waste--leachability of fly and bottom ash, pyrolysis byproducts, scrubber sludge, and the anaerobic digestion sludge--is a concern. Selection of landfill sites and facility siting may be affected.

Effluents discharged at disposal sites (pits, ponds, lagoons) are likely to contain the same ingredients that are present in raw municipal waste and may pose a hazard to water resources and ecosystems.

Waste-plant, front-end processing, storage, and transport operations may pose an occupational hazard to workers. Data indicate that dust, micro-organisms, hazardous chemicals, and noise are all highest close to equipment for providing and storage of municipal solid waste.

Emissions from combustion and co-combustion facilities are known to contain fly ash, organic compounds, and trace elements and are a health-and-welfare concern.

The presence of combustible dust may create explosion hazards. These operations also expose the general public to aesthetic problems (dust, noise, and odor), which can result in siting problems. Traffic flow in the vicinity of the plant is also a concern.

3. Conclusions

The major environmental effects associated with expanded production of synthetic fuels generated from biomass include the land erosion associated with farming and silviculture water-quality effects associated with wastewater disposal, residual solid wastes, and air-quality effects--especially from burning urban waste for power generation.

G. Domestic Onshore Oil and Gas

1. Background Considerations

The Annual Energy Review 1985 estimated that onshore, undiscovered, recoverable oil resources ranged from 42 billion barrels (Bbbls) of oil with a 95-percent probability to 71 Bbbls with a 5-percent probability (mean resource of 55 Bbbls). Onshore, natural gas resources range from 320 trillion cubic feet (Tcf) of gas with a 95-percent probability to 570 Tcf of gas with a 5-percent probability (mean resource of 430 Tcf).

The major areas for oil and gas activities (exploration and development) in the U.S. are within three regions: the Rocky Mountain Region, the Mid-Continent, and the Eastern Overthrust Belt. According to the 1984 International Petroleum Encyclopedia, 7,914 new-field wildcat wells were completed during 1982, with 1,402 wells completed as producers--for a success rate of 17.72 percent. That compares with 17.67 percent producers in 1981 and a record 19.05 percent in 1980. The 1,402 new-field discoveries of 1982 represent a 1.5-percent decrease from 1981. The American Association of Petroleum Geologists estimated that 1982's new-field discoveries contained reserves of 651.64 million barrels of oil and condensate and 3.84 Tcf of gas--a decrease of 0.2 percent in liquids and 10.7 percent in gas from figures reported for 1981.

2. Environmental Effects

The environment can be affected by the different phases of oil and gas activity--exploration and development, and production. The environmental effects of onshore oil and gas are similar to those already described (see Secs. IV.A and IV.B of this EIS). These include physical, biological, and socioeconomic effects resulting from drilling activities, transportation, and processing of the oil and gas.

In the exploratory phase, two activities--off-road-vehicle traffic and exploratory techniques--would have an effect on wildlife populations and habitats. Noise from heavy-duty exploratory vehicles and associated human involvement would adversely affect wildlife, particularly ground-nesting

birds, reptiles, and burrowing animals. Seismic exploration utilizes explosives, thumpers, and vibrators to test for oil and gas resources. These techniques disturb wildlife by disrupting their habitat and creating loud, sudden noise.

Off-road vehicles, seismic activity, drilling of test wells, excavation of construction materials (sand and gravel), and building of service roads and drilling pads cause soil particles to become unconsolidated and increase the soil's susceptibility to wind and water erosion. The disposal of drilling muds and dumping of waste oil in sump pits would contaminate soils in the area of drilling sites.

In areas where unstable soils are located and the potential for natural revegetation is low, such activities can cause long-range effects on surface-water quality, increase erosion, and decrease wildlife habitat and vegetative cover. Accidents such as fires, explosions, well blowouts, spills, and leaks can lead to major contamination and higher temperatures for surface waters when oil enters streams, ponds, or lakes, and to adverse effects on terrestrial vegetation.

Oil and gas activity can cause degradation of water quality and reduction of water supplies. During exploration, water supplies can be lost or reduced from seismic testing, stratigraphic testing, and wildcat drilling. During exploration, the ground-water hydrology can be altered from the fracturing of impermeable zones below aquifers, permitting the water resources to be lost or reduced through vertical drainage. Well drilling can also require large quantities of water, especially if porous and permeable formations are encountered. Oil spills and/or leaks, blowouts, and spills or leaks of caustic, salty, or polluted water can cause adverse effects.

During the development and production phase, the removal and handling of water from producing wells and separation facilities can cause further degradation of surface-water quality. Upon abandonment of a producing oil field, those facilities that contain residual oil, brine waste, or solid wastes may cause further water pollution. Batteries, tanks, sumps, and pipelines may deteriorate and release pollutants into adjacent surface and ground waters.

Injection of additional waters into a producing well may become necessary during the production phase to obtain additional oil production through flooding with massive amounts of water. This may be either fresh or produced (brackish) water. Such production techniques generally require additional water resources and deplete the availability of ground-water supplies.

3. Conclusions

The major environmental effects associated with expanded production of onshore oil and gas resources include effects on pristine areas from roads; off-road-vehicle traffic; and other oil and gas infr[illegible]ucture that generates loss of natural vegetation and erosion, effects on a[illegible]lity, and effects on water quality.

H. Geothermal Power

1. Background Considerations

Geothermal energy is the heat contained in and continuously flowing from the earth. Today, it is proving to be a viable source of energy for the generation of electricity and space heating. There are four different types of high-grade geothermal reservoirs that may be exploitable--(1) the hyperthermal system, (2) the geopressured system, (3) the molten-rock system, and (4) the hot-dry-rock system. At the present time, only the hyperthermal system is viable.

The hyperthermal systems that are being exploited around the world have extremely high temperatures (500-600°F) and often occur at depth (frequently 2 miles). All occur in hot, fractured rock with a high water content. This water serves as a heat-exchange medium that flows into the boreholes. The heat is then carried to the surface and to the electrical-generating turbines. The pressure of the overlying rock and water generally keeps the water in the reservoir in a liquid state, even when temperatures are far above the liquid's boiling point. However, as the drill bit penetrates the cap rock of the reservoir, the pressure is relieved and the contained water flashes to steam. A few reservoirs such as those found at the Geysers, California, and Lardarello, Italy, consist of superheated. high-pressure steam.

The largest geothermal development is underway at the Geysers Geothermal Field in California's Sonoma and Lake Counties, located about 90 miles north of San Francisco. The field yields almost 750,000 kilowatts of installed electrical-generating capacity. Plans presently call for an additional 220,000 kilowatts of capacity. Predictions are that full development in the Geysers Field will account for about 2 million kilowatts of generating capacity by the end of the decade (International Petroleum Encyclopedia, 1982). Pacific Gas and Electric Company's complex of 17 geothermal power plants at the Geysers produced a record 6 billion kilowatt-hours of electricity in 1983 (California Energy Update, August 8, 1984). See Table A-4 for annual U.S. production of electricity from geothermal sources.

Another development program is underway in southern California's Imperial Valley. The geothermal resources present would generate more than 3 million kilowatts of electrical-power capacity. A second prospect, Heber, in the Imperial Valley, contains enough geothermal energy to provide a capacity of 500,000 kilowatts for at least 30 years (International Petroleum Encyclopedia, 1982).

Utah Power and Light has proposed a 20,000-kilowatt electrical-power-generating plant fueled by geothermal energy from Roosevelt Hot Springs, in southwest Utah. Phillips Petroleum has also entered into a commercial geothermal venture at Roosevelt Hot Springs. The Roosevelt prospect is thought to be capable of supporting 200,000 to 400,000 kilowatts of power capacity. Other areas of potential development include the Jemez Mountains in New Mexico, Dixie Valley in Nevada, and Desert Peak in California.

2. Environmental Effects

Environmental effects from the development of geothermal resources vary depending upon the pre- and postlease exploration and development activities,

Table A-4
Production of Electricity from Geothermal Sources

Year	Net Summer Capacity On-Line (thousand kilowatts)	Production (million kilowatt-hours)
1979	667	3,889
1980	909	5,073
1981	909	5,686
1982	1,022	4,843
1983	1,207	6,075
1984	1,231	7,741
1985	1,590	9,325

Source: Energy Information Administration, Annual Energy Review 1985.

Table A-5
Solar Energy Collector to Land Ratios

Collector	Collector Area	Land Area
Solar Pond	1.0	1.0
Flat Plate	1.0	2.0-2.2
Photovoltaic Array	1.0	2.0-2.2
Parabolic Trough	1.0	2.2-2.4
Parabolic Dish	1.0	3.4-3.8
Heliostats	1.0	3.0-3.8

Source: Sheahan, 1981.

and the nature of the geothermal find. The chief effect from the use of geothermal power occurs during the period of development of the field and construction of the steam-gathering lines and power plants. Natural steam does contain a small percentage of noncondensable gases, including hydrogen-sulfide and methane, that are vented to the air and that may affect air quality. Impurities in the water released from the development of geothermal energy also may affect water quality in the area.

Any effects of geothermal development upon climate will be localized and should not affect regional patterns. Local temperature patterns will change by several degrees due to waste heat emitted from the power plants, particularly from the cooling towers.

According to Department of Interior (1980) Final EIS for Proposed Leasing within the COSO Known Geothermal Resource Area, the principal gaseous emissions associated with geothermal development are the noncondensable gases hydrogen sulfide (H_2S) and carbon dioxide (CO_2), and water vapor from flow testing and from cooling towers. In addition, fugitive dust will be emitted into the atmosphere as a result of construction and vehicle activity and by wind erosion.

Noise effects can result from direct geothermal activities such as well drilling and power-plant operation, and from related activities such as automobile and truck traffic. Noise can also result from developmental operations, during preparation and construction of well pads and power plants. Further noise effects are likely to occur during drilling, cleanout, and flow testing of new wells; noise associated with these activities is short-term.

The operation of the power plant represents the major long-term, continuous noise source resulting from geothermal development. Major contributors to the noise include cooling towers, turbines, and stream-jet ejectors. The cooling towers, which are physically large and have a large-band-frequency spectrum, become the dominant noise source at distances greater than 200 feet from the unit.

Subsidence and seismic activities may be accentuated during the production phase. The potential for subsidence is greatest in hot-water systems produced from unconsolidated sediment. Since the majority of geothermal systems are in more competent rock, they are not subject to large amounts of subsidence. Geothermal systems are often found in areas of seismic activity. Possible fault movements can result from the removal and reinjection of fluids causing cyclic variations in reservoir pressures.

Geothermal development requires cooling water, which could displace other uses or degrade other supplies. It also produces enormous amounts of liquid waste requiring disposal. Exploration and well drilling and construction of development facilities can cause short-term effects of surface erosion and drilling-waste disposal. This could cause alteration of surface runoff and erosion patterns, sediment yield, and ground-water degradation. The development and production of geothermal energy could lower the water table. Degradation of the natural water could locally reduce the temperature of the fluids, causing mineral precipitation and/or depletion of the geothermal reservoir.

The amount of land used and altered ranges from zero in the very earliest stages of exploration to many tens of acres in a field that has undergone fuel-stage development. Surface-disturbing activities generally are (1) road building; (2) drill-pad, power-line, and/or other facility-site construction; and (3) construction and clearance of pipelines and transmission facilities.

Effects on wildlife could result due to increased vehicular traffic, drilling activities, removal of wildlife habitat, and noise associated with construction and production activities.

Recreational uses would be affected by noise, dust, traffic conflicts, or physical displacement from specific recreation-use areas. Public-safety concerns could restrict recreational use of an area until drilling operations ceased. Geothermal development could modify the landscape character of an area if striking contrasts occurred in form, line, color, or texture of landscape features.

3. Conclusions

The major environmental effects generated by increased use of geothermal resources include the considerable noise associated with the operation of many geothermal-power plants, air-quality effects, development pressures in pristine areas, and water-quality effects.

I. Solar Power

1. Background Considerations

The sun is the earth's most abundant source of energy. Only an infinitesimal fraction of the sun's radiant energy strikes the earth. It is estimated that about 180 trillion kilowatts of electricity--more than 25,000 times the world's present industrial-power capacity--is received. However, this energy requires conversion to a suitable form.

Solar energy can be captured either directly through rooftop collectors, photovoltaic cells, and building-design features or indirectly through storage of solar energy in nature. In comparison to producing energy from conventional fuels, direct solar energy is relatively clean and pollution-free.

Solar systems convert the sun's radiation into energy for heating and air conditioning by means of absorptive coolers, industrial-process heat, and electricity generation. Photovoltaic cells convert sunlight directly into electricity, although the relatively low conversion efficiency requires large collector areas. Another method of utilizing solar power is solar thermal, wherein the sun's rays are directed by mirrors to a central point and are then capable of being used as the heating source for a thermal-power plant. There are four different solar-thermal systems that have different temperature ranges, applications, and types of collectors: (1) solar pond, 140-180°F; (2) flat plate, 100-250°F; (3) parabolic concentrating, 300-1,500°F; and (4) heliostats, 500-2,000°F. Much of the recent work in solar-energy production has focused on reducing the manufacturing costs of solar collectors, improving their efficiencies and reliabilities, and simplifying their design and installation.

Solar technologies will require more land per unit of capacity than will conventional-energy systems due to the diffuse nature of the solar resource and the generally low efficiencies of solar devices. If the facility is to provide process steam to an industry or utility, the collectors must be in close proximity to the point of end use. If the plant is electricity generating, it must give a clear access for an electrical interconnection with the local-utility-grid network. The amount of available solar radiation at a specific geographic location dictates the number and size of the collectors required. The amount of available solar radiation can vary dramatically from site to site. Table A-5 gives an estimate of the collector-area-to-land-area ratios.

Legal right to the sun is an important aspect of solar power. Height of structures, trees, or land features on adjacent land--especially on the south side--is important because of potential shading of the collectors. Sheahan (1981) reports the recommendation that there be an uninterrupted view of the south down to an angle of 10 degrees above the horizon and clear to the southwest and the southeast, to the point where the sun rises and sets on the summer solstice. This area may need to be controlled through legal restrictions or land acquisition.

Land surfaces need to be as flat as possible with grades not exceeding 10 percent. If the land is contoured, more spacing would be required due to potential shading from collectors on the higher ground.

Areas with excessive wind would need to be avoided, since windblown sand and dirt would erode mirrored collector surfaces. Similarly, high wind could cause structural damage to the sail-like collectors. Hailstones and heavy snowfalls could also damage the collectors. In addition, adjacent industrial facilities may give off air emissions that could erode mirrored collector surfaces.

2. Environmental Effects

The major environmental effect of solar-energy-conversion systems results from the relatively large surface area required for the collectors and from disruptions that occur during development. During the manufacture of photovoltaic cells, minimal air-quality effects would result, with some water-quality degradation occurring due to discharge of waste-rinse solutions. Other effects from solar-energy development include cooling-water (aquatic-thermal-pollution) requirements, height requirements for a solar-power tower, and heat and light-beam intensity from mirror collectors.

Solar energy will not contribute to air pollution except during the production of solar equipment or during the cleaning of the mirrors. Increasing solar use will cut emissions of particulates, hydrocarbons, sulfur oxides, carbon monoxides, and nitrogen oxides. At the same time, solar systems will not increase atmospheric carbon-dioxide levels that could cause major changes in global climate.

Some solar-thermal electric plants with once-through cooling could have significant water requirements. Leakage and disposal of antifreeze and anticorrosion fluids from solar heating and hot-water systems could produce a minor water-pollution problem.

The height of a solar-power tower is significant and could be potentially as high as 1,000 feet for a 100-megawatt plant. Therefore, if a solar-plant site is proposed in proximity to an airport or major airline route, special precautions are required.

The solar reflections from heliostats and parabolic collectors can be very intense, and special precautions must be taken when working in the area of operating collectors. The solar beam with an intensity of approximately 70 heliostats in Albuquerque, New Mexico, melted through a one-quarter-inch steel plate in 2 minutes. Therefore, cleaning and maintaining the mirrored surfaces must be a nighttime procedure.

Biological resources can be affected during the installation and development stages. There also are many possible effects from support activities, such as road building to provide access to the solar sites, development of electric-feeder and transmission lines, and construction and maintenance of substations. Immediate habitat loss due to solar-energy development would occur during the construction of roads, solar plant, substations, and power-distribution and -transmission lines. Other indirect effects include increased human activity, noise and visual disturbance, and subtle habitat changes, such as the invasion of new plant species in disturbed areas.

3. Conclusions

The major environmental effects generated by increased use of solar-energy production include use of the major land areas needed for reflectors or heliostats with attendant loss of wildlife habitat; intense reflections from heliostats; and air- and water-quality effects associated with the manufacture of solar equipment. However, operation of solar-energy-production facilities does not cause air- or water-quality effects.

J. Wind-Turbine Power

1. Background Considerations

Wind has been used as an energy source for centuries. Historians believe that the earliest wind machines probably were primitive devices used to grind grain in Persia around 200 B.C. Manufacturers presently are producing small wind machines (less than 100 kilowatts) to be used in homes, farms, factories, and small businesses. Although the home market for wind turbines is growing rapidly, energy experts say that the type of wind technology most beneficial to the Nation will be the large turbines that feed electricity to the utilities. Several utilities are experimenting with wind power.

A wind turbine needs a supply of wind in order to operate. The velocity, direction, and time (frequency and duration) of the wind would need to be calculated prior to site selection. Potential obstructions such as buildings, vegetation, and other wind turbines can affect the supply of wind to a wind turbine in two ways--the velocity can be altered, and the turbulence can be increased.

A decrease in velocity means that reduced energy output and an increase in turbulence may also reduce the energy output and, perhaps more critically, reduce the useful life of the turbine. Buildings and vegetation are more of a

problem with small machines and with machines in urban areas. The only man-made structure in rural areas that would affect wind turbines is another wind turbine.

Southern California Edison's 10-year resource plan calls for generation of 2,100 megawatts of power from renewable resources by 1990. Wind turbines could contribute almost 7 percent of these needs and provide 1.226 trillion kilowatt hours on an annual basis (USDOI, 1982). Southern California Edison is targeting 360,000 kilowatts of wind-generated power by 1990 (International Petroleum Encyclopedia, 1982).

International Petroleum Encyclopedia (1982) reports that the Pacific Gas and Electric Company (PG&E) signed a contract with Windfarms, Ltd., of San Francisco to buy most of the 360,000 kilowatts to be generated. This project will entail installation of 146 wind turbines at a cost of about $700 million. When completed in 1989, it could yield as much as 963 million kilowatt-hours of electricity.

PG&E also plans to purchase all the electricity to be generated by a wind park to be built by U.S. Windpower of Burlington, Massachusetts. The project involves installation of 600 horizontal-axis wind turbines at an estimated cost of $60 million.

California Energy Update (August 8, 1984) reports that wind-project developers within California are announcing and installing record numbers of wind turbines. Over 2,400 wind turbines totaling more than 250 megawatts have been approved by zoning commissions and planning councils or announced by project developers. Major permitted wind-turbine projects include Altamont Pass, a total of 7,626 wind turbines; San Gorgonio Pass, a total of 1,352 wind turbines; and Tehachapi, 280 wind turbines. A total of 2,400 turbines have already been erected at Altamont Pass.

2. Environmental Effects

The primary environmental effects that would result from wind-turbine-energy production include adverse ecological effects from site development and presence of the structures, noise levels, interference with television reception, and potential recreational and visual conflicts.

Biological resources can be affected by many stages of wind-energy development, including initial material acquisition and processing, turbine production and assembly, and turbine installation and operation. There are also many possible effects from support activities, such as road building to provide access to turbine sites, development of electric-feeder and transmission lines, and construction and maintenance of substations. Other indirect effects include increased human activity, noise and visual disturbance, and subtle habitat changes, such as the invasion of new plant species in disturbed areas.

The USDOI (1982) reports that the direct effects of wind-energy development on biological resources include two main categories: (1) loss of animals through surface disturbance at turbine sites and in road and along powerline rights-of-way; and (2) at substation sites, disturbance of animal behavior through interference with courtship, rearing of the young, feeding, and other necessary aspects of animal-life histories.

Wildlife activity would decrease significantly in the immediate construction area or facility site, and animal habitats near development will often be deserted. If associated long-term indirect effects are high, the developed area may be permanently abandoned. Such indirect effects include immediate habitat loss as well as long-term, cumulative habitat deterioration.

The potential exists for low incident rates of collision between birds and wind-turbine generators. Placement of large turbines along ridge tops may affect the behavior of large soaring birds that utilize air currents deflected upwards by the terrain as a source of lift. Certain species, including small mammals and lizards, would be very vulnerable to crushing and other direct effects from construction of the turbines and roads.

Noise effects can result from the construction of the wind turbines by earth-moving equipment and increased traffic on local roads and highways in the study area. There are a number of potential noise sources from wind-turbine operations. Noise would be generated from the operation of the generator, the transformer, and the gearbox, and from the wind-turbine blades. The turbine blades would be the predominant noise source in the far-field of the wind turbine. The other noise sources would generally be discernible only in the near-field of the wind turbine.

Noise would be generated from a number of phenomena associated with wind-turbine-blade interaction with the air. The primary causes of noise are (1) fluctuating lift resulting from the interaction of the blades with the atmospheric turbulence of the wind, (2) interaction of the blade turbulent-boundary layer with the trailing edge of the blade, (3) direct acoustic radiation from the turbulent-boundary layer, (4) direct acoustic radiation from the wakes of the blades, and (5) interaction of the tower wake with the turbine blades on wind turbines where the blades are downwind of the tower. Of these causes, the first two are the dominant causes of noise. Noise associated with the operation of the wind turbines has become an increasing concern with residents in the area of the wind park.

Placement of the turbines in an area can cause a reduction in the area's suitability for recreational and other land uses. Conflicts have arisen due to the potential placement of wind parks in areas designed for wilderness review, and in areas of highly concentrated archaeological resources. Wind turbines are highly visible because of their height. Wind development in an area would have a significant visual effect on the character of the existing landscape. Visual aesthetic effects would result from removal of vegetation; soil disturbances associated with construction of wind-tower pads, access and service roads, electrical-transmission lines; and introduction of a variety of wind-turbine structures.

Wind and water erosion are likely to result from the construction of wind farms in an arid environment. Localized desert-pavement development would occur as a result of construction. This could result in a worsening of flood-hazard potential and downstream-sediment deposition. Changes in natural drainage courses could also increase channel erosion.

Wind turbines may interfere with television reception by causing visual distortions. Sengupta et al. (1980) report that interference to television reception is caused by the scattering of television signals by the wind turbines. In the vicinity of an appropriately oriented wind turbine, a television receiver will receive the scattered signals in addition to the direct signal. The scattering by the rotating blades of the wind turbine will produce both amplitude and phase modulations of the signals at the receiver. Since video information in television signals is transmitted by amplitude modulation, any extraneous amplitude modulation will, if sufficiently strong, distort the video reception.

The upper ultra-high-frequency channels are found to be particularly vulnerable to such distortions. For a given television channel, the maximum distance from the wind turbine at which adverse interference may occur is a function of the wind-turbine-blade dimensions and orientations and the receiving-antenna characteristics. The size of the interference decreases as the television-channel number is decreased.

3. Conclusions

Expanding the generation of electricity with wind power would cause the following major environmental effects: disturbance of sizable areas with thousands of giant windmills disrupting existing uses and affecting wildlife, visual impacts, considerable noise generated by the operation of windmills, and wind turbines interfering with television reception.

K. Hydroelectric Power

1. Background Considerations

Hydroelectric sites operating today were developed in the early 1950's. The total developed and undeveloped hydroelectric power in the U.S. is 6.75 trillion kilowatt hours (see Table A-6).

a. Hydroelectric Dams

Conventional hydroelectric developments convert the energy of naturally regulated streamflows to produce electric power. The construction of a dam for hydroelectric power interrupts the flow of a river, creating a lake or reservoir behind the dam. This alters the physically unstable riverine ecosystem and shifts it into a relatively stable lacustrine ecosystem.

PG&E's 65 hydroelectric plants produced three times more energy in 1983 (almost 18.1 billion kilowatt-hours) than in 1982. In addition to production from its own hydro plants, PG&E purchased 24.5 billion kilowatt-hours of economical hydro power produced mainly in the Pacific Northwest. Hydroelectric power accounted for 59 percent of the electricity available to PG&E customers in 1983.

b. Pumped-Storage Projects

Pumped-storage projects generate electric power by releasing water from an upper pool to a lower storage pool and then pumping the water back to the upper pool for repeated use. A pumped-storage project consumes more energy than it generates but converts off-peak, low-value energy to high-value, peak energy. To meet peak-load requirements, power companies have been utilizing pumped-storage hydroelectric stations to a greater degree. There are many

Table A-6
Hydroelectric Power in the United States - Total Potential

Geographic Division	Average Annual Generation (1,000 kilowatt hours)
New England	13,589,232
Middle Atlantic	37,763,815
East North Central	9,779,997
West North Central	17,645,343
South Atlantic	34,324,480
East South Central	27,879,762
West South Central	10,585,090
Mountain	97,658,028
Pacific	249,284,546
Alaska	176,290,145
Hawaii	333,400
Total - United States	675,133,838

Source: Federal Power Commission, 1976.

advantages to pumped-storage hydroelectric power, which increases the number of sites acceptable for construction of dams whose primary purpose is to supply peak-power needs.

Relatively small streamflows can support large generating capacities, since water is stored and a portion of it can be reused. The pumped-storage plant also does not require a large stream in a deep, natural valley.

PG&E announced in 1984 that the Helms Pumped-Storage Project, the largest hydroelectric plant in its 65-plant hydro system, had begun commercial operation. Located about 50 miles east of Fresno, California, the plant produces electricity during peak hours by drawing water from the Courtright Reservoir. Once the water passes through the hydraulic-turbine generator, it is released into Wishon Reservoir. The units are then reversed and the water is pumped back up to the Courtright Reservoir for use during the next peak period. Each of the three units at the Helms Project is capable of generating 402,000 kilowatts (California Energy Update, July 1984), and total capacity would be approximately 1.2 million kilowatts. This makes any one of the units among the largest reversible hydroelectric systems in the world.

2. Environmental Effects

The generation of hydroelectric power causes a variety of environmental effects. The following information describes effects resulting from hydroelectric dams and pumped-storage projects.

a. Hydroelectic Dams

Construction of a dam represents an irreversible commitment of the land resources beneath the newly created lake. Flooding eliminates wildlife habitat and prevents uses such as agriculture, mining, and some recreational activities. The interruption of the river's flow, even if only temporarily eliminated during the period required for the reservoir filling, can affect the flora and fauna downstream. However, with the construction of a dam, new water-related recreational facilities will be generated.

Changes in the hydrologic system resulting from the construction and operation of a hydroelectric dam are physical but can directly and indirectly bring about changes in all the dependent biological and human systems.

With the construction of a dam, the relative stabilization of the water level in the basin would affect the volume of discharge and current velocity downstream, thereby affecting the energy flow of the ecosystem. Increased input to ground-water supplies could result in possible benefits to distant aquifers. In comparison to the previous riverine ecosystem, reduction in turbidity through settling of sediments and possibly from the reduction of erosion in the new lake could result. Furthermore, probable reduction of turbidity downstream may also reflect settling (basin action) of the reservoir, in addition to benefits of stabilized water flow through the system. An increase in basin evaporation loss could occur due to (1) the existence of a large open body of water and (2) increased evapotranspiration of emergent aquatic plants.

A change of water chemistry would be detectable within the reservoir, and in some cases would cause stratification of the water, represented by deep-water,

oxygen-depleted zones. These zones would be unable to support fish life. Decomposition within the reservoir of submerged vegetation and organic material may produce an explosive release of chemical nutrients into the biosystem. Alteration of water temperature would occur not only within the reservoir but also downstream, influenced by lake-water outflow from the dam.

Depending on factors such as moisture content, temperature, and movement of air masses, along with regional topography and size of reservoir, alteration in the local microclimate may result from a hydroelectric impoundment.

The biological systems in the reservoir area and downstream usually show marked changes as a result of the dam's effect on the hydrologic system. This can have an effect on both terrestrial and aquatic ecosystems. The terrestrial habitat above the dam shrinks as the reservoir fills, yet the land/water interface increases. Both factors will be reflected in the floral and faunal changes.

If seasonal flooding has been arrested downstream, long-established patterns of water/soil-fertility relationships would be altered. Net reduction of soil-moisture content and changes in nutrient input and nutrient cycling would result in changes in flora and fauna.

The initial flooding that covers plants, animals, and organic-soil components sets the stage for a sudden release of nutrients into the water. This can cause an increase in the density and extent of higher aquatic plants. An increase in the aquatic plants within the reservoir can, in turn, cause interference with human activities such as boating, fishing, and even power generation (should the turbines or water intakes become clogged).

For migratory aquatic (e.g., fish) species, a hydroelectric dam may act as a physical barrier that can be ultimately destructive to a species population.

b. Pumped-Storage Projects

Lakes and impoundments created for pumped storage are usually much smaller than those created by dams. The effect on local water systems caused by the construction of a dam can be severe (see Sec. J.2 of this appendix) and can affect total changes in the area. The pumped-storage-project changes need not be as great, since they are physically smaller and constitute branches of local water systems. Water in pumped-storage systems can be reused. Natural flows are required only for make-up purposes and the initial filling. Percolation from the upper reservoir into locally surrounding land can cause land instability and water-quality effects. The reservoirs can cause disruption of migratory- fish species. Nonmigratory species seem to survive in the upper reservoirs; therefore, this area can be utilized for sportfishing.

Although each case is special--involving local characteristics of terrain, water quality and flow patterns, fish populations, human factors, and effects on visual appearance of the countryside--the total adverse effects are less than those of the conventional hydroelectric-power plant.

3. Conclusions

The major environmental effects associated with increased use of hydroelectric power include irreversible commitment of the land and resources beneath newly constructed lakes, modification to destruction of river or streamflow patterns below the dam, and changes in the ecology of the floodplain below the dam.

L. Nuclear Power

1. Background Considerations

Commercial use of nuclear fission as an energy source has a history of less than 30 years. This first electric-power-generating plant went into operation at Shippingport, Pennsylvania, in 1957. At the present time, there are 95 operable nuclear-power-generating plants in the U.S. with a summer capacity of 79.5 million net kilowatts (see Tables A-7 and A-8). Although nuclear energy is an alternative-energy source, delays and cancellation of plants have occurred. Since the incident at Three-Mile Island occurred, it has been argued that nuclear-power plants are unsafe and uneconomical.

The two main types of nuclear reactors include light-water reactors--which are widely used in the U.S. breeder reactors, and gas-cooled reactors--which are used in the United Kingdom. Light-water reactors include two types--the boiling-water reactors and pressurized-water reactors. The fuel in both is usually slightly enriched uranium in the form of oxide pellets contained in stainless-steel and zircaloy tubes. Water is used as both coolant and moderator.

In the boiling-water reactor, the cooling-water boils in the core, and the steam generated is used directly to drive a steam turbine, thereby driving a generator. The steam is then condensed to water and pumped back to the reactor to complete the cycle. Thus, the reactor acts as the boiler in the process.

In the pressurized-water reactors, the core-cooling water is kept at a very high pressure and is heated to 600°C. The water is then sent to a separate heat exchanger, where a secondary water supply is boiled and used to drive the turbines.

The problem with the boiling-water-type reactor is that the cooling water becomes radioactive from slight leaks in the thin cladding of the fuel rods and/or radioactively induced by the neutrons just outside the cladding. The radioactive steam goes directly to the turbines, so great care must be exercised to avoid steam leaks in the turbine. This problem is avoided in the pressurized-water-reactor system, because the cooling water and the steam for driving the turbines are separate.

McMullan et al. (1983) report that there are two main criticisms of light-water-moderated reactors. First, it is alleged that the technology of welding the very heavy steel sheets of the pressure vessels is not capable of providing the necessary reliability. This is important due to the potential catastrophe that would occur if the pressure vessel ruptured. Second, there are the possible effects of a sudden failure in the water supply to the core; if this occurred, the large mass of fuel and radioactive-fission products could become so hot as to cause a meltdown. From a meltdown, radioactive containment could possibly infiltrate the ground-water supply and become a hazard.

In breeder reactors, neutrons are captured by U238 to form PU239. No moderator is used in the reactor core to slow the neutrons down; as a result, the neutrons are captured by the uranium. From this reaction, the reactor produces significant quantities of plutonium.

The breeder reactor has some unpleasant characteristics that are regarded by its critics as rendering it unacceptable for generating electric power. The first of these is that plutonium is highly toxic. It also has a very low thermal conductivity that adds to the difficulty of extracting the heat from the reactor core. Further, there is no moderator. The core runs at a very-high-energy density and must be cooled, not by water or by a gas, but by a liquid metal--sodium. Therefore, the sodium must reach extremely high speeds in the tightly packed core in order to remove the heat that is generated. Failure to remove the heat would lead to a situation that could cause a meltdown, if left uncorrected.

Sodium reacts explosively with water. In the breeder reactor, the sodium is pumped around the reactor core at an elevated temperature; after a while, the coolant becomes radioactive. Any rupture or leak in the cooling system would cause an extremely violent reaction.

Another major criticism of the breeder reactor is that it uses plutonium in its fuel. The fuel rods are enriched in PU239, which can be used as fuel for a nuclear bomb. However, it is likely that any country with the capability to build and operate a series of nuclear-power facilities on a commercial scale also will have the capability to construct the rather less complex facilities needed to prepare fissile materials for nuclear weapons.

Most failures of commercial reactors have been minor in nature except for the incidents at Three-Mile Island and Chernobyl, U.S.S.R., which indicate the potential dangers of nuclear-power generation. Since the Three-Mile-Island incident occurred, there has been a large increase in public concern for the safety of these power plants. Attempts have been made to stop all future construction and shut down all existing nuclear plants in some areas. Yet dependence on this power source tends to preclude total shutdown, because no suitable alternative is available.

2. Environmental Effects

In addition to numerous land use and ecological effects associated with the construction of a nuclear-power plant, there are environmental effects that may result from the utilization of nuclear energy. These include thermal pollution of cooling water, leakage of radiation into water and air, production and transport of the fuel to the use site, radioactive-waste management including transportation and storage or disposal, and the potential for a catastrophic nuclear-reactor accident.

Nuclear plants are essentially the same cooling process as fossil-fueled plants and, thus, share the problem of heat dissipation from cooling water. However, nuclear plants obtain 33-percent conversion to electricity with all

Table A-7

Status of Nuclear-Reactor Units, December 31, 1985

Status	Number of Reactors 1/: Boiling-Water Reactors	Pressurized-Water Reactors	Other 2/	Total	Capacity 1/ (thousand net kilowatts): Total	Average 3/ (per reactor)
Operable 4/	33	60	2	95	62,809	785
In Startup	1	2	0	3	3,431	1,144
Construction Permits Granted	7	23	0	30	59,064	1,114
Construction Permits Pending	0	0	0	0	0	--
Units on Order	0	2	0	2	2,240	1,120
Total	41	87	2	130	127,544	924

Source: DOE, April 1984; Energy Information Administration, Annual Energy Review 1985.

1/ The capacity for operable units is net Maximum Dependable Capacity (MDC). For other units, the capacity is net Design Electrical Rating (DER).

2/ Includes one graphite-moderated and one gas-cooled reactor in full operation.

3/ Based on the net DER.

4/ Includes units with "full power" or "operating license" units (units in power ascention or in commercial operation). Excludes the following previously licensed units which have been inoperative for at least 4 years: Humboldt Bay, Dresden-1, and Three-Mile Island-2. Three-Mile Island-1 is considered operable although it has not been permitted to operate since March 1979.

Table A-8

Nuclear-Power-Plant Operation

	1979	1980	1981	1982	1983	1984	1985 1/
Operable Reactors (Number)	68	70	74	77	80	86	95
Nuclear-Based Electricity Generation (million net kilowatt hrs)	255,155	251,116	272,674	282,773	293,677	328,177	383,700
Nuclear Portion of Domestic Electric Generation (percent)	11.4	11.0	11.9	12.6	12.7	13.6	15.5
Net Summer Capacity of Operable Reactors (million net kilowatts)	49.33	51.06	55.53	59.55	62.81	69.70	79.50

Source: Energy Information Administration, Annual Energy Review 1985.

1/ Preliminary Data

the remaining 67 percent going to the cooling water, thereby requiring larger amounts of cooling water and discharging greater amounts of waste heat to the water than comparably sized fossil-fuel plants. In comparison, per unit of electric energy generated, modern fossil-fuel plants contribute 1.2 units of aquatic-thermal pollution, while nuclear plants contribute 2.0 units.

Thermal pollution causes damage by upsetting or modifying aquatic ecosystems. Thermal pollution can disrupt an ecosystem in a variety of ways: (1) large temperature increases that can kill many aquatic species; (2) reduction of available oxygen (as temperature increases, solubility of oxygen decreases); (3) alteration of the rate of biological activity (i.e., rapid growth of algae or pond weeds); (4) reduction of resistance to diseases; (5) alteration of behavior patterns; and (6) providing a competitive advantage to species that can tolerate temperature changes.

Increased concern has been raised regarding the potential danger of radiation leakage. When an organism sustains a large dose of radiation, acute somatic damage can result. Radiation can cause fatal damage to a large number of cells, resulting in sickness (nausea, vomiting, headaches, weakness, and sometimes death) and delayed somatic damage when an organism receives a dose of radiation that is not fatal. Cells that are lethally damaged by the dose will not reproduce and will be eliminated. Cells that are nonlethally damaged will stay with the organism and may later cause malfunctions (cancer, cataracts, prenatal abnormalities, and nonspecific shortening of lifespan). Genetic damage may result where a reproductive cell is nonlethally affected, and this may give rise to a genetically defective offspring.

While effects associated with an accident in a nuclear-power plant are serious, a more long-term effect can result due to the storage problems associated with the waste products from power generation. Low-level radioactive wastes from normal operation of a nuclear plant must be collected, placed in protective containers, and shipped to a federally licensed storage site and buried. High-level wastes created within the fuel elements remain there until the fuel elements are processed. There exists a potential for radioactive leakage during transportation activities or accidents.

Low-level radioactive solid wastes are buried in near-surface trenches at specific sites where topography, meteorology, and hydrology are such that migration of radioactivity is not anticipated. Low-level waste from a 1,000-megawatt plant and the fuel-cycle activity attributed to the plant require about 2.0 acres of land per year.

High-level wastes are currently stored as liquids in tanks, although storage in bedded-salt formations deep underground has been suggested. Spent fuel is currently stored at facilities licensed by the Nuclear Regulatory Commission. Plans call for recovering unused fuels at reprocessing plants, solidifying the wastes, and placing them in storage at Federal repositories.

The effects associated with the mining and milling of uranium ore are similar to those for coal mining (see Sec. C of this appendix), with the exception of radioactive tailings and water being produced.

3. Conclusions

The major environmental effects associated with expanded use of nuclear energy include the need to mine, process, and use radioactive materials that would result in the release of small amounts of radiation; disposal of the heated cooling water; difficulties associated with selecting and using a suitable disposal site for spent fuel; and considerable public concern about possible accidents.

M. Conservation

1. Background Considerations

This section briefly addresses reducing energy consumption through a variety of improvements in the energy efficiency of each of the five energy-consuming sectors of the U.S. economy--transportation, residential, commercial, industrial, and transformation. Over the past decade, projections of future energy consumption by the U.S. have changed dramatically as a result of much higher world energy prices. A decade ago, projections of U.S. energy consumption in the year 2000 ranged from 150 to 175 quads. The NEPPP's 1985 projections of energy consumption in the year 2000 range from a low of 88.8 quads in the high U.S.-energy-efficiency case, to a high of 104.8 quads in the high U.S.-energy-supply case, with the reference case at 98.6 quads. (The 1985 NEPPP was prepared before the rapid decline of world oil prices in 1986. If lower world oil prices persist, future U.S. energy consumption will increase in response to both lower prices and higher world economic wealth. Nevertheless, projections of future U.S. energy consumption include substantial improvements in the efficiency with which energy is used in the U.S. economy.) Table A-9 provides a comparison of the projected energy consumption for each sector under the assumptions of both the NEPPP-reference case and the high U.S.-energy-efficiency case.

The NEPPP-reference case includes future improvements in energy conservation that are both technologically expected and economically efficient. Future energy consumption is projected for each sector using the energy-conservation improvements that are either already available or expected, given anticipated technological improvements. The rate at which these energy-conservation improvements enter in the NEPPP-reference case is determined by consumer preferences under projected future energy prices. Projected improvements in energy efficiency play a major role in the projected future energy consumption by each sector of the U.S. economy.

Within each of the five categories of energy use, the demand for energy services is the result of two typically offsetting trends--an upward trend caused by population and economic growth, and a downward trend caused by increased efficiency in the use of energy stimulated by higher energy prices. Brief summaries of the expected energy conservation for each sector, which are abstracted from the 1985 NEPPP-reference case, are presented below.

In the residential sector, energy is consumed for space conditioning, lighting, and operating appliances. Total energy use in this sector is dependent on the total number of households and the energy consumed by each. The Census Bureau estimates that, between 1984 and 2010 (the projection period for the 1985 NEPPP), the number of housing units will increase by 30 percent. The

Table A-9
Comparison of NEPPP-Reference and High-Energy-Efficiency Cases
(Quads)

YEAR	TOTAL ENERGY TO U.S.	ENERGY LOSSES TRANS-FORMATION	LIQUIDS	GASES	COAL SOLIDS	ELEC-TRICITY	RENEW-ABLE 1/	TOTAL	RESI-DENTIAL	COM-MERCIAL	INDUS-TRIAL	TRANS-PORT.
			ENERGY USED BY FINAL CONSUMERS EXCLUDING INPUTS TO UTILITIES AND SYNTHETICS									
ESTI. 1984	76.6	-18.0	29.6	15.2	3.1	7.8	2.8	58.5	9.9	6.1	22.6	19.8
PROJ.												
1990 REF. CASE	87.3	-22.1	32.3	16.7	3.8	9.1	3.3	65.2	10.8	7.2	28.2	19.2
HIGH EFFIC.	81.6	-20.6	30.6	15.3	3.5	8.5	3.1	61.0	9.7	6.7	26.2	18.5
1995 REF. CASE	93.1	-25.2	32.3	17.5	3.7	10.3	4.0	67.9	11.2	7.8	29.6	19.4
HIGH EFFIC.	85.4	-23.3	30.0	15.5	3.3	9.5	3.7	62.1	9.7	7.2	27.0	18.4
2000 REF. CASE	98.6	-28.0	32.9	17.4	3.9	11.5	4.8	70.6	11.3	8.4	30.4	20.7
HIGH EFFIC.	88.8	-25.6	30.0	15.0	3.4	10.5	4.3	63.3	9.6	7.7	27.0	19.2
2005 REF. CASE	104.2	-30.9	32.9	17.2	4.6	12.8	5.8	73.3	11.3	8.8	31.9	21.4
HIGH EFFIC.	92.7	-28.0	29.6	14.5	3.9	11.5	5.3	64.8	9.4	8.0	27.7	19.7
2010 REF. CASE	110.8	-34.5	33.0	16.8	5.4	14.3	6.9	76.3	11.2	9.4	33.5	22.3
HIGH EFFIC.	97.9	-31.0	29.4	13.9	4.4	12.8	6.3	66.8	9.5	8.6	28.4	20.4

Source: U.S. Department of Energy, National Energy Policy Plan Projection to 2010, December 1985.

1/ Renewable central electric is included in electric column.

estimated 1984 average end-use efficiency for the residential sector was 72 percent. The rate of energy-efficiency improvements is projected to be 14 percent over the 1984-to-2010 period. Thus, the net result under the assumptions of the NEPPP-reference case is a gradual increase in total-residential-energy consumption.

In the commercial sector, energy also is consumed for space conditioning, lighting, and operating appliances. Since 1970--apparently in response to the energy-price increases of the last decade--commercial-energy use per square foot has been declining at a little less than 2 percent per year. The estimated 1984 average end-use efficiency of the commercial-sector equipment was 81 percent. The pattern of increased energy efficiency in the commercial sector is expected to continue through the projection period. The net result may be a leveling off in the commercial-sector-energy payments per square foot, despite the projected increase in energy prices.

The industrial sector consumes energy resources for space conditioning, lighting, operating machinery, and feedstocks used to manufacture certain products. In response to the energy-price increases of the 1970's, the decline in energy use per unit of industrial output accelerated from 2 percent per year to 4 percent per year. It is likely that the rate of energy-efficiency improvements has peaked and, therefore, that an average improvement of 2 percent per year is used in the projections. Decreased energy use per unit of output is projected to result from improved process efficiency and a change in the product mix being produced, with energy-intensive productions decreasing as a share of the total.

Motor vehicles (cars and trucks) use the largest share of energy consumed--about 75 percent--to transport people and goods. About one-fourth of the energy consumed in the transportation sector is used in the operation of pipeline, air, rail, and marine transportation. Because of improvements in both the design and mechanics of motor vehicles, it is estimated that the actual road miles per gallon (mpg) for the entire fleet of motor vehicles has increased by as much as 85 percent since the early 1970's. (The actual road mpg for the entire fleet of cars and trucks should not be confused with the EPA's estimated mpg for new cars.) The 85-percent improvement in the actual road mpg represents less than a 2-mpg improvement for the entire fleet of cars and trucks to its present level of around 15 mpg. Improvements in the energy efficiency of the total U.S. fleet are expected to plateau at around 23 mpg toward the end of the projection period. However, the average fleet road mpg will continue to increase beyond 2010.

The two energy-transformation-sector industries are electric utilities and synthetic fuels. Large energy losses are unavoidable in these industries. In terms of energy actually delivered to the end-use sectors, the utility industry has been, for at least the last 20 years, and is expected to continue to be around 32-percent efficient. This is not to say that little has changed or will change in the utility industry. In the 1960's, coal and hydro facilities lost share to oil and natural gas. In the 1970's, this movement reversed; and oil and gas lost share to coal and newly completed nuclear facilities. This trend is expected to continue through the year 2000. See the sections of this appendix that address coal and nuclear and synthetic fuels for further discussion of these trends.

The high-energy-efficiency case in the 1985 NEPPP used assumptions that generate a 10-percent improvement in the overall end-use efficiency in the year 2000 by comparison to the reference case. The efficiency assumptions that were changed to generate this improvement include the consumer discount rate, the energy demand per unit of industrial output, and the fuel efficiency of each transportation mode. Perhaps the most important factor is the assumed change in the discount rate that consumers use in deciding to purchase higher-efficiency equipment like furnaces, air conditioners, and insulation. (By assuming a lower discount rate for consumer decisions, the economic attractiveness of energy-efficient investments is improved.) Further, the high-energy-efficiency case decreased the energy use per unit of industrial output such that energy use was 15 percent lower than in the reference case. The higher-fuel-efficiency assumptions for the transportation sector increased actual road mpg 10 to 12 percent over those used in the reference case. (See Table A-9 for the full sector-by-sector comparisons and the changes in total energy consumption over the projection period.)

Five major types of conservation options are often proposed as substitutes for a wide variety of energy-development projects: (1) improved gas-mileage performance, (2) greater use of mass transit, (3) improved energy efficiency of household appliances, (4) higher energy efficiency in the industrial and commercial sectors, and (5) augmented public and private research in energy conservation. The proposals to use conservation rather than to develop an energy resource typically start with an observation of historical improvements in the efficiency of energy use in the U.S. and other economies. They then assume a specific rate or amount of future improvement and calculate energy savings via the difference between present-use rates and the assumed future-use rates. All such proposals should be examined against the information provided above concerning projections of future gains in U.S. energy efficiency. Very considerable further improvements in energy efficiency are part of the expectations built into the projections of future energy consumption. Thus, much of the calculated energy savings or conservation assumed for each of the five major energy-conservation options are already counted.

Nearly all energy-conservation policies can be classified in one of five broad categories--price, supply restriction/allocation, regulation, incentives, and information.

Price: Energy consumption would be cut by relying on consumers' reaction to higher prices, either for petroleum or for all forms of energy.

Supply Restriction/Allocation: In order to reduce energy consumption, energy supplies would be restricted to a fixed level. Then, employing some nonmarket allocation or rationing scheme, the limited supply would be distributed among competing uses or users.

Regulation: Regulations could be developed that would place restrictions on how energy could be used and would outlaw those uses or technologies thought by lawmakers to be the most wasteful.

Incentives: Incentives, usually monetary, can be developed for energy-saving forms of production and consumption. On the other hand, disincentives, such as taxes, could be used to discourage specific kinds of waste.

Information: Programs would be developed to change consumers' habits of energy use, either by exhorting them to change their lifestyles or by pointing out the economics and other advantages of particular energy-saving practices.

2. Environmental Effects

The reduced production and consumption of energy resources associated with various energy-conservation proposals generates much of the public appeal for these proposals. Simply by learning to use less energy, which appears to have neither cost nor environmental effects, the adverse environmental effects caused by production and use of the energy resources conserved will be avoided or reduced. Potential energy savings through conservation methods would result in reduction of the environmental effects associated with energy production and use.

This summary of the environmental effects of energy conservation separates possible future energy conservation into two parts. The first is the energy conservation that is expected to occur as a result of improved technology in response to future energy prices. This part is included in the 1985 NEPPP-reference case, and it is called "expected conservation" in this summary of environmental effects. The second part of possible future energy conservation includes all additional energy conservation that could result from changes in government policies. (These possible policy changes are summarized at the end of Sec. M.1 in this appendix.) This part of possible future energy conservation is called "additional conservation" in this summary of environmental effects.

The environmental effects associated with the expected part of possible future energy conservation are wholly beneficial. The reductions in energy consumption in the four energy end-use sectors expected to occur under the assumptions of the NEPPP-reference case will mean that fewer pollutants associated with energy use will be emitted.

The environmental effects associated with the additional part of possible future energy conservation are primarily beneficial. The reductions in future energy use that could result from changes in government policies would further reduce the levels of pollutants associated with energy use.

There are, however, costs associated with the additional conservation scenario. Energy-conservation improvements that are mandated by government programs rather than in response to consumer preferences reduce the total value of the Nation's goods and services and thus reduce National income. Such reductions are a form of adverse effect on the quality of the human environment.

Conserving energy resources under government-policy changes could require considerable investments in new or retrofitted equipment. There are environmental effects associated with production of the capital goods needed for most energy-conservation options. For example, production of the more fuel-efficient boilers used in retrofitting existing commercial and industrial buildings would generate a variety of adverse environmental effects that otherwise would not occur. Similarly, in order to render existing buildings more energy-efficient, materials whose production entails adverse environmental effects may be used.

3. Conclusions

Reduction of the environmental effects associated with production and consumption of energy resources is one of the primary advantages of energy-conservation measures. However, the investments and programs often associated with improved energy efficiency generate environmental effects. Thus, energy-conservation options are not void of environmental effects.

N. Combination of Alternatives

A combination of some of the most viable energy sources available to this area (discussed above) could be utilized to attain an energy equivalent comparable to the estimated production within the anticipated field life of this proposed action. However, in order to attain the needed energy mix peculiar to the infrastructure of this area, this combination of alternatives would have to consist of energy sources--attainable now or within the suggested timeframe--that are transferable to the technology presently used. Viable substitutes would have to be available for the petroleum and natural gas required by the petrochemical-industrial complex; the petroleum used for the transportation sector; and the electricity and fuels used in residential and commercial sectors.

Allowing favorable technologies and economies, the most viable domestically available energy alternatives would probably consist of the use of coal, oil shale, tar sands, and biomass to produce synthetic liquids; nuclear energy and coal to compete for the utility market; and renewables to supply a sizable portion of total energy requirements. The environmental effects of each of these alternatives have been discussed briefly in the previous sections. The result will be a long-term energy-supply transition from crude oil to alternative-energy sources and less dependence on oil imports. Such patterns will require new and efficient technologies, major capital investments, and a high rate of growth in coal production.

The future U.S. energy-source mix will depend on a multiplicity of factors--the identification of resources, research-and-development efforts, development of technology, rate of economic growth, economic climate, changes in lifestyle and priorities, capital-investment decisions, energy prices, world oil prices, environmental-quality priorities, government policies, and availability of imports.

It is unlikely that there will ever be a single definitive choice among energy sources, or that development of one source will preclude development of others. Different energy sources will differ in their rate of development and the extent of their contribution to total U.S. energy supplies. Understanding of the extent to which they may replace or complement offshore oil and gas requires reference to the total National energy picture. Relevant factors are:

-- Historical relationships indicate that energy requirements will grow in proportion to the gross National product.

-- Energy requirements can be constrained to some degree through the price mechanisms in a free market or by more direct constraints. One important type of direct constraint that operates to reduce energy requirements is the substitution of capital investment in lieu of energy, e.g., insulation to save fuel. Other potentials for lower energy use have more far-reaching effects and may be long-range in their implementation--they include rationing, altered transportation modes, and major changes in living conditions and lifestyles. Even severe constraints on energy use can be expected only to slow, not halt, the growth in energy requirements within the timeframe of this statement.

-- Energy sources are not completely interchangeable. For example, solid fuels cannot be used directly in internal-combustion engines. Fuel-conversion potentials are severely limited in the short term, although somewhat greater flexibility exists in the longer term and generally involves choices in energy-consuming capital goods.

-- The principal competitive interface between fuels is in electric-power plants. Moreover, the full range of flexibility in energy use is limited by environmental considerations.

-- Regulation of oil and gas prices lowered the price below the product level that refiners (and consumers) paid for domestic oil and prevented the incremental cost of all domestic producing fields from equating to the price of imports. This impaired the economy's ability to adjust to world energy prices. Under deregulation, the real prices of oil and gas will be closer to the marginal costs of alternative energy.

-- A broad spectrum of research and development is being directed toward energy conversion--more efficient nuclear reactors, coal gasification and liquefaction, liquefied natural gas, and shale retorting, among others.

Several of these factors could assume important roles in supplying future energy requirements, although their future competitive relationship is not yet predictable.

B

APPENDIX B

MAJOR PROJECTS CONSIDERED IN CUMULATIVE EFFECTS ASSESSMENT

MAJOR PROJECTS CONSIDERED IN CUMULATIVE EFFECTS ASSESSMENT

Information in this appendix supplements and updates material contained in Appendix B of the final Environmental Impact Statements (FEIS's) for Sales 71 and 87, which are incorporated by reference (USDOI, MMS, 1982 and 1984, respectively). The other source used extensively for Projects 1 through 6 is Maynard and Partch et al., 1985. The 18 projects described in this section are depicted on Graphic No. 6 and summarized in Table IV-A-7. Projects in Table IV-A-7 are numbered to correspond to the project number in the text. As on the table, projects are segmented under three broad categories: Existing Development (Projects 1 through 8), Exploration and Potential Development (Projects 9 through 16), and Future Lease Sales (Projects 17 and 18).

EXISTING DEVELOPMENT

1. Trans-Alaska Pipeline (TAP): Approximately 16.3 square miles are occupied by the 800-mile pipeline that runs between the Prudhoe Bay Unit and Valdez. Between Prudhoe Bay and Fairbanks, the Dalton Highway (Haul Road) was constructed parallel to the pipeline. Ten pump stations move about 1.7 million barrels of oil a day through the pipeline. Two additional pump stations could be added and drag-reduction agents introduced that would take capacity past its design capacity of 2 million barrels per day to approximately 2.4 million barrels a day. The Alyeska Pipeline Service Company designed, constructed, and now operates the TAP (Alyeska Pipeline Service Co., 1984).

2. The North Slope Borough (NSB) Capital Improvement Program (CIP): One of the goals in the formation of the NSB was improvement of living conditions in North Slope Inupiat villages. With revenues from the Prudhoe Bay field, a network of Borough and construction subcontractor management, and maximum participation of Inupiat men and women in each project, this massive CIP has been used to construct schools and housing in every village, acquire gravel and land, improve airport runways, improve fuel generation and water and sewer systems, acquire maintenance equipment and search-and-rescue helicopters, and initiate areawide communications and solid-waste-disposal improvements for every village of the North Slope during the 1970's and early 1980's. Many of the projects have been completed. The focus of future expenditures emphasizes health and human services, safety, and the maintenance of facilities already built (NSB Ordinance 86-10 et seq).

Previously, the CIP proposed the development of conceptual master plans for service bases at Bullen Point and Kuparuk (NSB, 1983). Although these areas still may serve as industrial centers for North Slope oil and gas development, the focus of the CIP has been redirected.

3. Prudhoe Bay Unit (PBU): The PBU produces 1.5 million barrels of oil per day from the Sadlerochit formation, approximately 17 percent of the total U.S. production. Sixteen companies are included in the unitized field. ARCO Alaska, Inc., operates the east half of the field and Standard Alaska Production Company operates the west half. Approximately 4,000 persons are employed for this field. Major facilities include base camps for Standard and ARCO personnel, a crude-oil-topping plant, a central gas facility, airstrip, flow stations, gas-injection facilities, two docks, seawater-treatment plant, water-injection plants, and a power system. Additional facilities for support

activities have been located at Deadhorse. Approximately 348 kilometers of roadways and 1,160 kilometers of oil and gas pipelines have been constructed within the PBU. (This includes 80 km of pipeline constructed for Lisburne production.) (See Table B-1 and Fig. B-1.)

Original well spacing was based on 160 acres per well; spacing is being reduced to 80 acres per well. Gravel pads, which typically are 46 meters by 400 meters, accommodate up to 40 wells. Waterflooding, a secondary recovery technique, is expected to increase production by approximately 1 billion barrels. Initially, the waterflood process was accomplished by reinjecting into the reservoir formation waters produced with Prudhoe Bay oil. Subsequently, seawater processed at the treatment plant has been injected. The processed seawater is distributed via 13 miles of 40-inch-diameter pipe to the eastern injection plant and 11 miles of 36-inch-diameter pipe to the western injection plant. Operating the waterflood system increased employment at Prudhoe Bay by 42 persons per shift. Waterflood equipment, including the world's largest seawater-treatment plant and two injection plants, was shipped by barge in the summer of 1983. The 26,000-ton, 11-story treatment plant is the largest module ever shipped to the PBU.

In addition to waterflooding and infilling, production was increased further when the world's largest gas processing plant came on line. As much as 335 million cubic feet per day of miscible gas are injected through 42 injection wells to enhance production at 152 production wells. As much as 50,000 barrels per day of liquid natural gas can be comingled with the Prudhoe Bay crude oil and piped through the TAP (Oil and Gas Journal [OGJ], 1987).

4. Lisburne Field: The Lisburne Field lies under the PBU. ARCO committed $575 million in 1984 to develop the first phase of a commercial field. Permits have been issued for expanding five onshore drill sites, roads, and gathering facilities; the sixth platform is offshore. Prior to issuing a permit for the offshore portion of the development, the U.S. Army Corps of Engineers (COE) is preparing an EIS. Issues that are being addressed in the EIS include the individual and cumulative effects relating to the loss of anadromous fish habitat; hindrance to anadromous fish migration; and changes in current and circulation patterns, water quality (temperature and salinity), and coastal processes (USDOD, U.S. Army COE, 1985).

ARCO constructed 80 kilometers of pipeline and drilled approximately 180 wells on six pads for an initial production rate of 100,000 barrels per day in 1987. Three to four rigs would be used for drilling between 1985 and 1991. From 100 to 240 persons would be employed during drilling, and about 1,000 persons would be employed during construction. ARCO plans to upgrade and expand housing and support facilities at the ARCO camp to accommodate workers for 60 permanent positions. Filling these positions could require 200 to 250 employees (Maynard and Partch et al., 1985, and Andrews, personal comm., 1985). One drill site could be in the center of Prudhoe Bay; the North Slope Borough has given tentative approval of a 2.5-mile causeway for the offshore platform. The NSB approval is contingent upon implementing an adequate fish-monitoring program and provision of a fish-enhancement program if the solid-fill causeway interferes with fish migration (Epler, 1985).

5. Kuparuk River Unit: The Kuparuk River oil field lies approximately 30 miles northwest of Prudhoe Bay. ARCO, the major shareholder, operates the unitized field for the eight owner companies. Oil in place is estimated to range from 4 to 5 billion barrels. Total recoverable oil with a successful waterflood is estimated at 1.6 billion barrels. A waterflood-demonstration project began in 1983. Peak production of 250,000 barrels per day began in 1986, making Kuparuk second only to Prudhoe Bay in U.S. daily production. A total of 800 wells (including oil, gas, water, and injection wells) ultimately will be drilled. At full production, almost 500 persons will be employed to operate the field. Facilities include living and dining quarters; a water- and sewage-treatment plant; warehouses; offices; a central processing plant; an operations center; construction camps; and a 1,700-foot gravel airstrip. A bridge across the Kuparuk River connects the 150 kilometers of roads in the Kuparuk Field to those of the PBU. Oil is transported via 668 kilometers of pipeline. Pipeline distance includes a 24-inch pipeline running 26 miles to the TAP (See Table B-1 and Figure B-1). In 1984, the 24-inch pipeline replaced a 16-inch pipeline that had been in operation since 1981 (Snapp, 1984).

6. West Formation: The West Sak formation lies within the boundaries of the Kuparuk River Unit. Construction information is included in the totals for the Kuparuk River Unit in Table B-1. ARCO conducted a pilot project in this formation to determine the potential for full-scale production. ARCO used eight wells to produce the oil and five additional wells to inject hot water to drive the production. Through this project, ARCO demonstrated that the oil could be recovered by conventional methods; development would not occur until oil prices improve and become more stable (Anchorage Daily News, Jan. 21, 1987). If the field is developed fully, wells spaced every 20 acres would produce between 100,000 and 200,000 barrels per day. Total production could reach 2 billion barrels. ARCO estimates 15 to 25 billion barrels are in place, of which 20 percent ultimately might be recovered (OGJ, 1984).

7. Endicott Development Project: In December 1984, the COE issued a permit under Section 10 of the River and Harbor Act of 1899 and Section 404 of the Clean Water Act to Standard Alaska Production Company for the Endicott Development Project.

Work permitted includes construction of two gravel islands approximately 2.5 miles offshore and 15 miles east of Prudhoe Bay; a 3.1-mile solid-fill gravel causeway connecting the two drilling islands; a 1.9-mile gravel causeway with 700 lineal feet of breeching extending from the Sagavanirktok (Sag) River Delta to the interisland causeway; a 1.5-mile gravel-causeway approach through the Sag Delta, and an 8.7-mile gravel road through Sag Delta wetlands that would intercept with the existing Prudhoe Bay road system at Drill Site 9; elevated oil pipelines along the onshore road segments to TAP Pump Station 1; and an onshore disposal pit to contain drilling effluents determined to be unsuitable for offshore disposal. Sohio also received permission to stockpile the overburden from the gravel source/sources required. Activities to date include the placement of approximately 6.2 million cubic yards to construct the two production islands, the causeway, and road (see Table B-1 and Fig. B-1). Gravel was hauled by 44 belly-dump trucks working two 12-hour shifts at a rate of 43,000 to 45,000 cubic yards per day. Major activities completed in 1986 include the installation of the bridges for the breeches; construction of a base camp for 600 people, warehouse and office facilities, and the base

operations center; installation of smaller modules (e.g., seawater intake basin utilities, fuel tanks, etc.); laying pipelines; development drilling; and completing the final slope on the islands. In 1987, the laying of 45 kilometers of oil pipelines should be completed and a dock constructed to receive the large modules scheduled to arrive in the 1987 sealift. Production should begin in December 1987 Standard Alaska Production Co., Public Affairs Dept. (personal comm., 1985 and 1987).

8. Milne Point Unit: Conoco operates Milne Point, an (approximate) 21,000-acre field that is located north of the Kuparuk River Unit. The field was identified by Conoco in 1970 but was not considered economic to develop until 1979 when the area was unitized. Housing modules for both the 50-person permanent camp and the 300-person construction camp were delivered in 1984. Development modules were shipped on three barges during the 1985 sealift. During the period of construction, approximately 300 persons resided in camp. The construction camp is located adjacent to the permanent camp and can be opened and closed in segments to facilitate accommodating varying sizes in the work force. About 30 kilometers of roadways were built (see Table B-1 and Fig. B-1). Approximately 24 kilometers of oil pipelines were constructed from the drilling sites in the Milne Point field to the West Kuparuk pipeline (see Table B-1). Production from 24 wells located on two pads began in November 1985 at approximately 10,000 barrels a day. Production was suspended in 1986 pending an increase in and stabilization of the price of oil. Recoverable resources are estimated at 100 million barrels (Anchorage Daily News, Nov. 6, 1985, and Hastings, personal comm., 1986).

EXPLORATION AND POTENTIAL DEVELOPMENT

9. Discovered Resources (Oil Fields, Gas Fields, and Mining): Possible new projects that are described in Maynard and Partch et al. (1985) primarily include oil resources too viscous to produce and gas resources. Although these projects are not on the immediate horizon, given appropriate technology, market prices, and infrastructure, they could be processing commercial quantities of oil or gas on short notice.

Oil Fields: Gwydyr Bay oil is thought to be pooled in a very small area between two faults. The 27,160-acre field, located north of the west operating area of the PBU, was unitized in 1979 and is still being evaluated. Conoco, Hamilton Brothers, Cities Service Company, and Mobil/Chevron have drilled approximately eight wells. A ninth well located just onshore will be drilled in 1987.

Between 6 to 11 billion barrels of oil have been identified in the Ugnu Sands, which lie in the northern part of the Kuparuk River Unit and the Milne Point Unit. Because the oil is extremely viscous, no plans to develop the field have been proposed.

The Simpson Lagoon Field consists of two wells drilled during the late 1960's. Although oil was found, no additional work on the field has been undertaken.

Gas Fields: Several gas fields contain resources that could be recovered should the infrastructure for transporting the gas be constructed. Two fields that fall in this category already are associated with oil production. Estimates for gas from the Prudhoe Bay gas cap indicate 2 billion cubic feet per day could be extracted for 25 years without substantially affecting the production of oil. Proven resources total 28,183 trillion cubic feet. Estimates of gas resources at Endicott indicate initial production could reach 250 million cubic feet per day for 20 to 30 years.

Other fields with significant gas potential include Point Thomson and Gubik. The Point Thomson Unit is located between the Canning River and Bullen Point Camp. Exploration began in 1975 and 15 wells have been drilled to date. Although 350 million barrels of gas condensate have been estimated for the Point Thomson Unit, no announcements of field development have occurred (Van Dyke, personal comm., 1985). Production is contingent upon a gas-marketing scheme for the North Slope (OGJ, 1985). Gubik is located near the eastern border of the National Petroleum Reserve-Alaska (NPR-A) on land owned by the Arctic Slope Regional Corporation. Estimates reach 317 billion cubic feet.

The Kemik, Kavik, and East Umiat fields contain lesser accumulations. Kemik and Kavik could be commercial only if a gas pipeline were constructed adjacent to them. East Umiat is considered noncommercial.

Mining: The Red Dog Mine, located in the Northwest Arctic Borough, currently is being developed by Cominco Alaska, Inc. The mine is owned by the NANA Regional Native Corporation. The port through which the ore will be shipped is south of Kivilina. NANA shareholders will hold the majority of the jobs for this project.

Along the Chukchi Sea coast from Cape Lisburne to Wainwright, especially near Cape Beaufort, coal and its development also is a potential source for cumulative effects on the North Slope. During 1984, a State-funded study of coal resources in the western Arctic was conducted to determine if the resources could be used as an economic replacement for the fuel oil currently being imported into the villages. The coal deposit of the Deadfall Syncline, located 6 miles from the Chukchi Sea and about 40 miles south of Point Lay, was identified as the best source for this use. A detailed feasibility assessment was completed in 1986. Development of this resource has been recommended and awaits further funding (Arctic Slope Consulting Engineers, 1986).

10. Seal Island: Seal Island is constructed on a lease obtained by Shell during the Joint Federal/State Beaufort Sea Lease Sale held in 1979. Recovery of 300 million barrels of oil has been estimated from a discovery announced by Shell in January 1984. Shell would like to start producing about 100,000 barrels per day of oil, possibly by 1992. An oil discovery from Northstar was announced in January 1986. This discovery helps to define the Seal Island reservoir (Alaska Report, Jan. 22, 1986). Amerada Hess drilled one well and spudded a second from Northstar during the 1985 to 1986 drilling season (Van Dyke, personal comm., 1987).

11. National Petroleum Reserve-Alaska: The NPR-A is administered by the U.S. Department of the Interior (USDOI). Resources are estimated at 6.4 billion barrels of oil and 11 trillion cubic feet of gas; recoverable reserves are estimated at 1.85 billion barrels of oil and 3.74 trillion cubic feet of gas.

More than 90 wells have been drilled on NPR-A (Schindler, 1983). Although none has proven commercial, the wells that have been drilled in Simpson Field

(35 wells with an estimated 12 million barrels in place) and Umiat (11 wells with an estimated resource of 66 million barrels) may eventually become commercial (Maynard and Partch et al., 1985). In compliance with the 1981 Department of the Interior Appropriation Act, as amended, the USDOI has undertaken studies and initiated a leasing program in NPR-A. Two lease sales were held in 1982 in which the most promising areas were leased. Plans call for one lease sale a year for 5 years beginning July 20, 1983. However, no acreage was leased in 1984. Due to continued lack of interest, no sale has been held since then. Two areas have been deleted from lease-sale plans, removing approximately 3 percent of the estimated oil resources. One deletion is the core of the Western Arctic caribou calving area and the other includes approximately 85 percent of the black brant molting area north of Teshekpuk Lake. Leasing on the First Creek Delta saltmarsh waterfowl area has been deferred 5 years. In 1985, drilling began on areas leased under the NPR-A program. The first well, drilled on the Brontosauris Prospect about 30 miles south of Barrow, was plugged and abandoned.

12. Oil and Gas Leasing in the Arctic National Wildlife Refuge (ANWR): The ANWR is situated in the northeastern part of Alaska. The boundaries of the coastal plains portion of the ANWR facing the Beaufort Sea extend from the Canning River Delta on the west to the Canadian border on the east.

Controversy as to whether or not the coastal plain of ANWR should be open for oil and gas exploration and development led Congress to create Section 1002 of the Alaska National Interest Lands Conservation Act (ANILCA). This section laid out guidelines for the Secretary of the Interior to follow prior to reporting to Congress with recommendations for the use of the coastal plain, or 1002 area. The U.S. Fish and Wildlife Service (USFWS) released its final legislative Environmental Impact Statement (FLEIS) on the potential effects of exploration and development on the coastal plain in April, 1987 (USDOI, FWS, 1987). The FLEIS analysis was based on a 150-mile pipeline that would extend from the easternmost development hypothesized in ANWR to TAP pump station 1 (see Fig. 2). The conditional, economically recoverable resource in the mean case was estimated at 3.2 billion barrels with a 19-percent probability of oil being present. Approximately 12,650 acres, or 0.8 percent of the 1002 area, would be modified from its initial condition. Approximately 200 to 300 miles of all-season gravel roads within several oil fields and about 110 miles of road between the Canning River and the marine facilities at Pokok Lagoon are assumed.

The Secretary of the Interior recommended to Congress that the entire Arctic Refuge coastal plain (Alternative A) be made available for oil and gas leasing. Other alternatives identified in the ANWR FLEIS for consideration by Congress are: (1) limited leasing of the 1002 area (Alternative B)--there would be no leasing or other oil and gas activities in the traditional core-calving area of the Porcupine caribou herd; (2) allow further exploration (Alternative C)--this would include exploratory drilling, allow permits for obtaining additional data by the Government, industry, or both to determine whether or not to authorize leasing of the 1002 area; (3) take no further legislative action (Alternative D)--this would allow the prohibition against oil and gas leasing, exploration, and development to continue; and (4) designate the area as wilderness (Alternative E)--no further study or public review process would be necessary for this action.

Section 1003 of ANILCA states "production of oil and gas from the Arctic National Wildlife Refuge is prohibited and no leasing or other development leading to production of oil and gas from the range shall be undertaken until authorized by an act of Congress." This prohibition on down-hole hydrocarbon exploration was modified as a result of the land exchange between the USDOI and the Kaktovik Inupiat Corporation and the Arctic Slope Regional Corporation (ASRC). Through this exchange, the Native corporations received 92,000 acres within the refuge. Up to three exploratory wells may be drilled on this acreage prior to congressional action. As noted above, however, no development can proceed without congressional approval.

Another activity permitted in ANWR is geophysical fieldwork. This work must be conducted consistent with USDOI guidelines developed to protect the renewable resources of the refuge (ANILCA Sec. 1002[d]). Three types of geologic surveys have been permitted--surface geology, gravity magnetic, and seismic. Between 1983 and 1985, 18 permits were issued to conduct surface geology studies. Some of these permitted work in multiple years. One permit was issued to conduct a gravity-magnetic and control-net survey. Only 1 of 12 applications for seismic surveys was issued. More than 2,460 kilometers of seismic lines were run over the course of two winters (1984 and 1985). This work provided the USFWS with the necessary data for the report on ANWR that was delivered to Congress in April 1987. No future seismic work is anticipated until authorized by Congress.

13. Recent State of Alaska Arctic Lease Sales:

Sale 34: This sale was held in May 1982 for acreage in the Prudhoe Bay uplands. The lease area straddled the Arctic Slope and Northern Foothills petroleum provinces. The northeastern quadrant is adjacent to two significant discoveries at Point Thomson (State of Alaska, Div. of Policy Dev. and Planning [DPDP], 1982b).

The State offered 1.23 million acres in 261 tracts; 119 tracts were leased. Many of the leased tracts were along the Canning River, the western boundary of the ANWR. Two wells were drilled in 1984; both were abandoned. No further drilling has been proposed (Van Dyke, personal comm., 1985).

Sale 36: This sale was held in September 1982. Acreage offered equalled 56,862 acres--41,500 acres were submerged lands north of Prudhoe Bay near Midway Islands and approximately 15,500 acres included both submerged lands in the Flaxman Island-Canning River area and uplands along the northwest border o the ANWR. Oil potential is considered high for the eastern tracts and low for the Midway Islands tracts. The scenario for this lease sale assumed development from the eastern tracts would begin within 10 years of the sale and that production would join a pipeline previously built to accommodate production from Point Thomson (State of Alaska, DPDP, 1982a). One well was drilled in the spring of 1983 (Butts, personal comm., 1983).

Sale 39: This sale, held in May 1983, was for 211,956 acres between the Colville River Delta and Gwydyr Bay. Nine tracts totalling 43,000 acres along the delta were eliminated for environmental reasons, and 5,000 acres along the boundary of the territrial sea were deleted because title to them was in dispute. Thirty-nine mitigating measures were stipulated to safeguard against

environmental and sociocultural effects. Leases in Sale 39 are eligible for "exploration drilling credits" for the first exploratory well drilled on each tract (State of Alaska, DNR, 1983).

Sale 43: This sale, held in May 1984, offered tracts immediately west of Sale 39. Tracts extended west from the Colville River Delta to Pitt Point (at the east end of Smith Bay). Sale 43A, offering nine tracts at the mouth of the Colville and six tracts much farther south, was held concurrently. All tracts, except three offshore, received bids. Three stipulations and 41 additional terms of the sale are applied to these leases.

Sale 47: In May 1985, the eastern portion of the Kuparuk Uplands was offered in Sale 47. This area includes approximately 600,000 acres between the Kuparuk and Sagavanirktok Rivers. Petroleum potential is considered moderate to high.

Sale 48: In February 1986, the Kuparuk Uplands south of the Kuparuk oil field were offered for lease in Sale 48. Of 54 tracts offered, 104 received bids; 266,736 acres were leased.

Sale 48A: Eleven tracts totalling 42,053 acres in the Mikkelsen Unit were reoffered in February 1986. All tracts received bids.

14. Post-Sale Activity on Areas Leased in Previous OCS Sales in the Beaufort Sea: Three sales have been held for Beaufort Sea OCS oil and gas leases. The first sale, held in December 1979, offered Federal and State submerged lands and State offshore islands. The second sale, held in October 1982, offered tracts primarily west of Prudhoe Bay and east of Smith Bay. Finally, Sale 87 offered tracts between Barrow and Canada and generally out to the 200-meter isobath. Leases were awarded on 372 tracts totalling 786,617 hectares. Based on projections given in Table II-1, oil resources in the leased area are estimated to be 600 million barrels. In the 6 years following Sale 87, the drilling of 14 exploration wells is anticipated. Two platforms would be constructed for the production of oil, which would be pumped from 24 wells. The estimated 250 miles of pipeline are sufficient to transport oil from finds both east and west of the TAP. Capacity in the TAP should be adequate for all oil coming from the North Slope. Production of natural gas in the Beaufort Sea is considered uneconomic at this time.

Most of the drilling from leases issued in the joint sale has been done on State tracts. Indeed, the Endicott prospect (Project no. 7) is located on the State tracts. On Federal tracts, two wells drilled at Beechy Point were determined to be producible and were plugged and abandoned. Two wells drilled from Tern Island were determined to be producible and were temporarily abandoned. Results from a third well drilled into lease OCS-Y-197 are not yet available. Wells drilled from Seal Island also were determined to be producible (see Project no. 10) and have been temporarily abandoned.

Four wells have been drilled on leases issued in Sale 71. Both Mukluk (one well drilled from a gravel island) and the Antares prospect (two wells drilled from the Concrete Island Drilling System [CIDS]) were determined to be non-producible and were plugged and abandoned. Drilling of the Harvard prospect, located north of Kuparuk underlying Sale 71 block 424, was completed in 1985 from Sandpiper Island, a gravel island constructed in 1984. A discovery was announced in February 1986 and a delineation well was begun (Anchorage Daily News, Feb. 26, 1986). Drilling on the Mars prospect from an ice island was undertaken in 1986. Boundary modifications between State and Federal waters may affect the jurisdiction of this prospect.

Drilling from blocks leased in Sale 87 began in the summer of 1985. Drilling on the Hammerhead prospect north of the Canning River was completed in 1985. The drillship then was moved to the Corona prospect, located north of Camden Bay. The Corona prospect was completed in the 1986 drilling season and the drillship returned to the Hammerhead prospect where a second well was drilled. The Erik prospect, located northeast of Kaktovik, may be drilled in the future from the Kulluk, a conical drilling unit. Drilling for each of the three prospects was supported by three ice-class vessels--two smaller vessels were used for supplies and ice management and the third vessel, the Robert Lemeur, an icebreaker supply boat, was used to open the route to the drill site plus perform tasks similar to the smaller vessels. The Belcher prospect, located near the Canadian border, is scheduled to be spudded from a drillship in August 1987. Near Harrison Bay, plans call for using the CIDS to drill two or more wells on the Orion prospect located north of Cape Halkett. Northwest of Oliktok Point, Tenneco used the Single Steel Drilling Caison (SSDC) placed on a steel mat during the 1986 to 1987 season. (See Roberts, 1987, for a more complete description of activities that have occurred and are anticipated to occur on previously leased Federal tracts in the Beaufort Sea.)

15. Arctic Slope Regional Corporation Oil and Gas Leasing: The ASRC is a for-profit corporation created pursuant to the Alaska Native Claims Settlement Act of 1971. The Corporation has title to 4.9 million acres, both surface and subsurface estate, located in the northern part of the State. The ASRC lands are located principally to the west and to the south of the NPR-A boundaries. The ASRC has leased approximately half its acreage to various oil companies (Thomas, personal comm., 1985). Several exploratory wells have been drilled on ASRC leases to date; the most notable are the wells drilled in the ANWR (see Project no. 12) and Gubik, east of NPR-A (see Project no. 6).

16. Canadian Beaufort Sea: In 1982, Dome Petroleum Limited; Esso Resources Canada, Limited; and Gulf Canada Resources Inc. prepared a Beaufort Sea-Mackenzie Delta EIS. This description summarizes the information found in the Sale 87 FEIS (USDOI, MMS, 1984), which was based on information from the Dome Petroleum Limited et al. (1982) EIS; Alaska OCS Region Technical Paper No. 7 (Roberts and Tremont, 1982); and the Beaufort Bulletin, June, 1983.

According to its EIS, Canadian industry anticipates four offshore and three onshore reservoirs should be on line during the years of hydrocarbon production. For oil and gas exploration, delineation, production, and injection, 655 additional wells are expected. Between 1987 and 2000, the work force will increase gradually to approximately 8,500 persons. Construction of a gas pipeline between 1989 and 1992 could employ 10,000 persons and would peak in 1990. The figures used for the 1982 EIS for Canadian development are based on the confirmation of a commercial field by 1983 or 1984, production beginning as early as 1986 or 1987, minimum estimated reserves of between 6.3 and 32 billion barrels of oil, and a production rate of 700,000 barrels per day. Since then, resource estimates have been adjusted to 9.2 billion barrels and a production rate of 375,000 barrels per day (Hatter, 1984). Production will

begin in 1987 but on a limited basis (see current status). As a result, the dates used for the EIS should be adjusted by a minimum of 2 years into the future and the level of activity should be reduced.

Options for the transportation system that were considered for full production include a tanker route through the Northwest Passage, an overland pipeline through the Mackenzie Valley, or a combined tanker-pipeline route.

Current Status: Drilling began in the 1960's. By 1985, over 150 wells had been drilled in the Canadian Arctic, both offshore and onshore. Most oil shows, however, have been offshore. Among the promising fields is Amauligak; with resource estimates of 700 to 800 million barrels, it is considered the cornerstone to commercial development. In 1988, the mobile arctic caisson Molikpaq will be used to produce oil from Amauligak on a seasonal basis. Shipments of 2.5 million barrels a year will be transported by shuttle tanker around Point Barrow to Pacific Rim nations. Construction for sustained production via pipeline should begin 4 years later (OGJ, 1987). Other finds in the area include Tuk J-29, Pitsiulak, and Nipterk (OGJ, 1985). Wells have been drilled from gravel islands, caisson-retained islands (Tarsuit), bottom-founded mobil units (Semi-Submersible Drilling Caisson and Mobil Arctic Caisson), and floating units (drillships and a conical drilling unit).

Tuktoyaktuk and McKinley Bay are the primary service bases. Additional facilities are on Hershel Island and have been proposed for King Point in the Yukon Territory. McKinley Bay's ship-repair facilities are adequate to service the entire range of vessels present in the Arctic (Evans, personal comm., 1985).

FUTURE LEASE SALES

17. Future State of Alaska Leasing Offshore and Onshore: Eight lease sales in the Beaufort Sea and mid-Beaufort uplands are included in the State of Alaska's 5-year lease-sale schedule (State of Alaska, DNR, 1987). Offerings in the Beaufort Sea coastal area are considered to have moderate to high resource values. No sales are on the 1987 to 1991 lease schedule for acreage on or near the Chukchi Sea coast of the NSB.

Sale 50: Submerged lands in Camden Bay are scheduled to be offered in June 1987, in Sale 50. Included are 122,745 acres of submerged lands between Flaxman Island and the Hulahula River. This offering does not include submerged lands between the barrier islands and the ANWR.

Sale 51: Prudhoe Bay Uplands between the Canning River and Sagavanirktok River are to be offered in Sale 51 in January 1987. This sale includes approximately 592,142 acres comprised of expired lease acreage and new acreage. New acreage is that which was deleted from Sale 34 held in September 1982. This area has been identified as an area of moderate potential.

Sale 52: Sale 52 was deferred from September 1986 to January 1989. This sale includes approximately 184,320 acres of submerged lands extending from Pitt Point to Tangent Point, including Smith Bay.

Sale 54: Kuparuk Uplands are offered in Sale 54 scheduled for January 1988. Petroleum potential is rated moderate to high. Sale 54 includes 512,000 acres between the area offered in Sale 48 and the NPR-A boundary.

Sale 55: Approximately 299,520 acres of submerged lands between Camden Bay and Demarcation Point will be offered in Sale 55, scheduled for June 1988.

Sale 57: About 1,500,000 acres near the foothills of the Brooks Range between Umiat and Anaktuvuk Pass are to be offered in Sale 57, to be held in June 1990. Petroleum potential in the area is considered low to moderate.

Sale 64: This is a new sale added to the schedule in 1987. Located immediately south of lands to be offered in Sale 51, most of the area was offered previously in Prudhoe Bay Uplands Lease Sale 34 held in September 1982. The approximate 771,840 acres are to be offered in June 1991.

Sale 65: This new sale added to the 1987-1991 lease-sale schedule reoffers submerged Beaufort Sea acreage between Pitt Point and Flaxman Island. The sale is scheduled for June 1991 after leases sold in the 1979 Joint Federal/State Beaufort Sea Oil and Gas Lease sale expire.

18. Future Federal OCS Leasing:

Chukchi Sea: Under the proposed 5-Year OCS Oil and Gas Leasing Schedule for mid-1987 through mid-1992 (USDOI, MMS, 1987), two lease sale are proposed for the Chukchi Sea--Chukchi Sea Lease Sale 109, May 1988, and Sale 126, scheduled for 1991. Initial descriptions of activities that could ensue from a lease sale in the Chukchi Sea are provided in the Sale 109, Chukchi Sea Exploration and Development Report (USDOI, MMS, 1985e).

Of the 30 million acres in the Chukchi Sea Planning Area, 14 million acres are considered to have appropriate geologic structures. The area estimated to be leased ranges from 1,120,000 to 2,520,000 acres. Resources are estimated at 2.68 billion barrels, with the marginal probability of success of 20 percent. For the mean case, the hypotheses include the following: 20 exploration wells and 23 delineation wells would be drilled between 1989 and 1996, 9 production platforms would be placed in 1997 and 1998, and approximately 153 production wells would be drilled between 1997 and 1999. One shore base would be built to support production. Transportation could be either by tanker or pipeline or a combination of the two.

Beaufort Sea: The proposed 5-year leasing schedule (USDOI, MMS, 1987) contains one lease sale, Sale 124 scheduled for 1991, in addition to this sale for the Beaufort Sea. Activities for developing the entire Beaufort Sea that are assumed in Section II.A of this EIS apply also to the future sale. In summary, these assumptions include a peak annual production of 105 million barrels per year from four platforms. Production would occur between 1996 and 2011. During exploration and delineation (1985 through 1993), 52 wells would be drilled. A pipeline system linking offshore production to the TAP would be installed between 1990 and 1995. Onshore and offshore pipelines would each be 360 kilometers. Approximately 4,432 hectares would be disturbed during the laying of the offshore pipeline. A 360-kilometer road would parallel the onshore pipeline.

Table B-1
Cumulative Construction for North Slope Production

Production Units	Pipelines (km)1/	Roads (km)	Acreage Filled2/ (hectares)	River Crossings	Air Fields
Prudhoe Bay Unit (includes Lisburne development)	1,060	348	2,175	3 3/	2 4/
Kuparuk River Unit (includes West Sak pilot project)	668	150	570 5/	5	1
Endicott Development (all Sohio)	45 6/	25	22 7/	0	0
Milne Point Unit (between field and Kuparuk pipeline system)	24	30	80	1	0 8/
TOTAL	1,797	553	2,847	9	3

Source: Walker, et al., 1986; D.J. Moon, Standard Alaska Production Co., oral communication, April 1987; V. Dent, Atlantic Richfield Co., oral communication, April 1987; and A. Hastings, Conoco, Inc., oral communication April 1987.

1/ Pipeline figures include gathering lines and sales lines to TAP Pump Station 1 or connection with an existing sales line.
2/ Acreage-filled figures include fill for all facilities, drill sites, roads, and camps.
3/ These are major river systems and include the Kuparuk River, Putuligayuk River, and Sagavanirktok River; multiple crossings of each are made.
4/ One is the paved State airport at Deadhorse.
5/ ARCO estimates that 1% of the Kuparuk Unit is filled or has been affected by gravel as a result of the fills.
6/ Figure includes kilometers of pipeline for produced fluids between the two gravel-production islands.
7/ Gravel fill includes 18 hectares for the 2 gravel-production islands and 4 hectares for the roadway.
8/ An airstrip is available at the abandoned DEW line site at Milne Point.

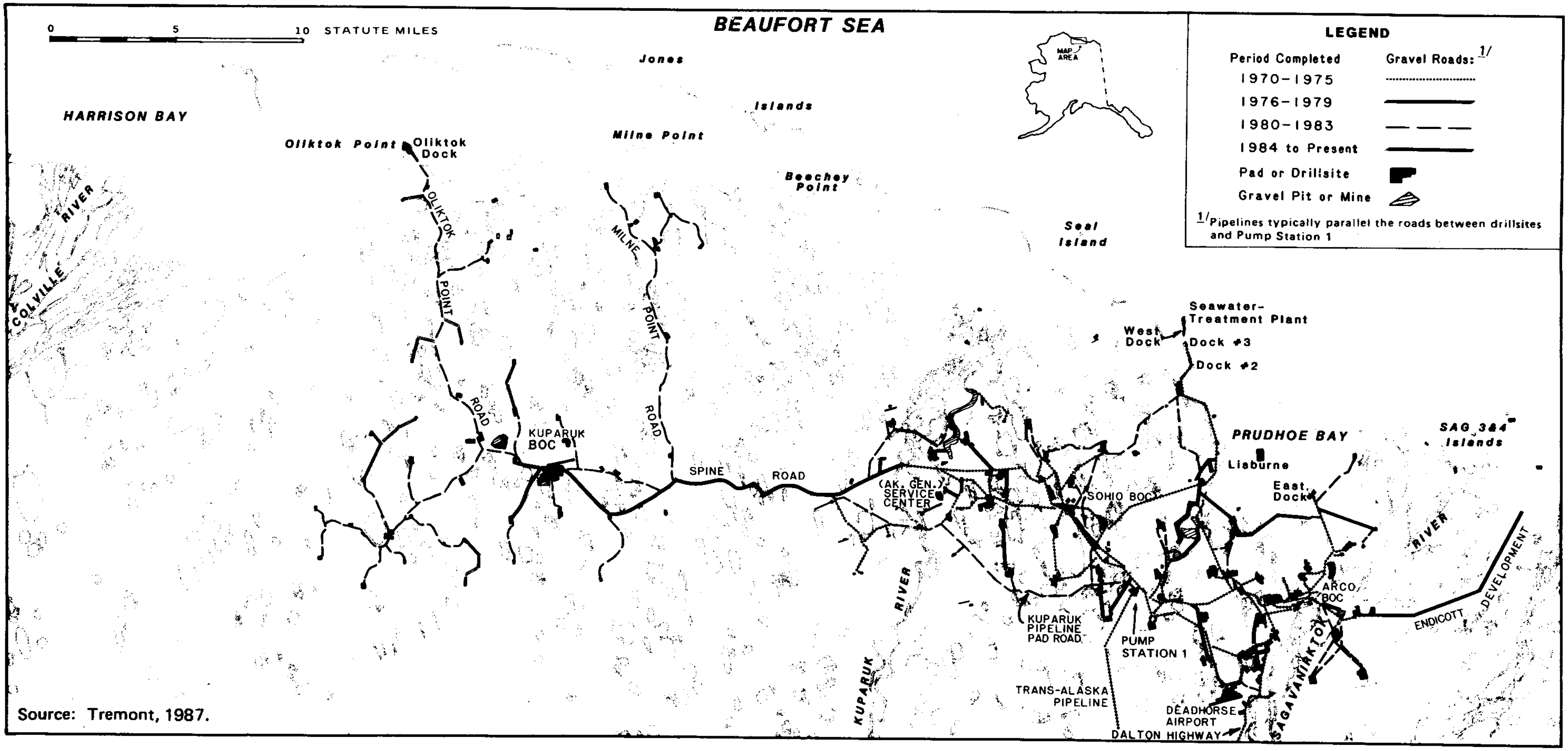
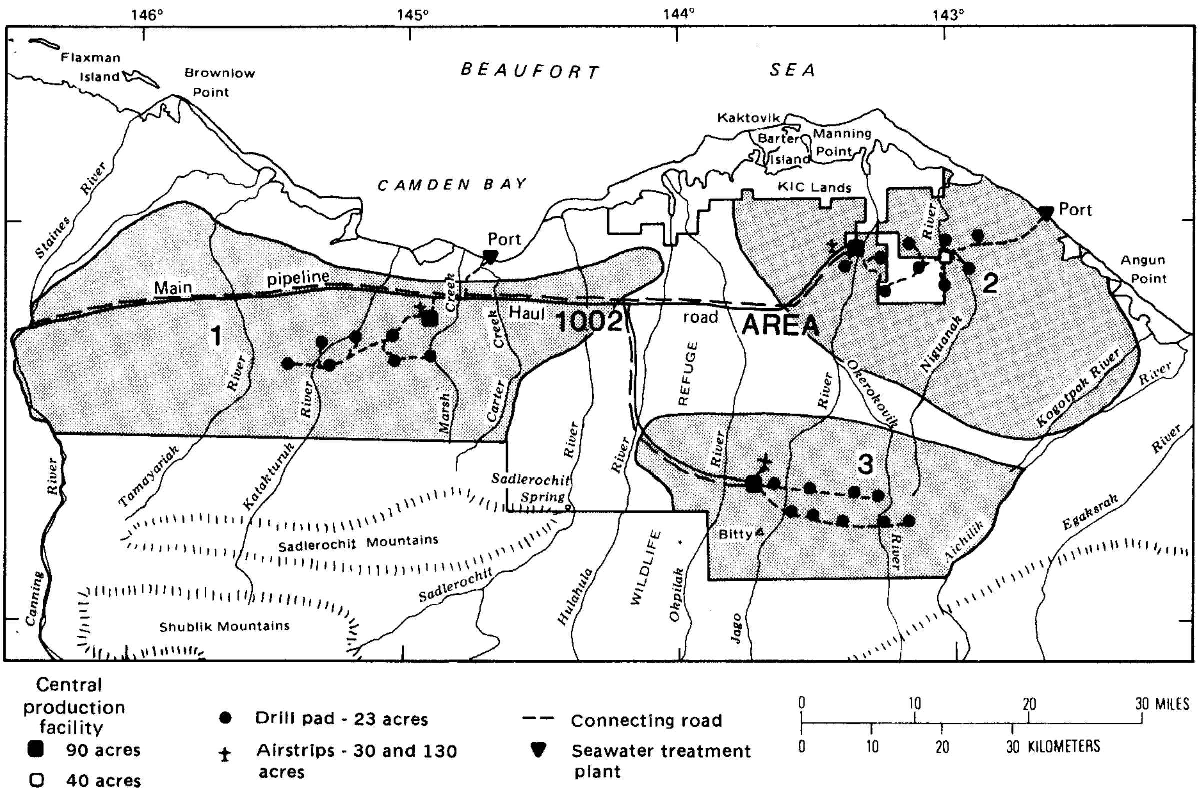


FIGURE B-1. SPATIAL AND TEMPORAL GROWTH OF NORTH SLOPE SURFACE–TRANSPORTATION INFRASTRUCTURE



Source: USDOI, FWS, 1987.

FIGURE B-2. HYPOTHETICAL GENERALIZED DEVELOPMENT OF THREE MAJOR PROSPECTS WITHIN THE 1002 AREA UNDER FULL LEASING IF ECONOMIC QUANTITIES OF OIL ARE DISCOVERED. NUMBERS INDICATE THREE LOCALITIES (SHADED) HAVING TYPICAL PROSPECT CHARACTERISTICS.

C

APPENDIX C

OIL SPILLS AND OIL-SPILL RESPONSE

I. FATE AND BEHAVIOR OF SPILLED OIL

The description of the behavior and fate of spilled oil in general and in specific regard to surface spills, subsurface spills, summer broken-ice spills, and winter broken-ice or under-ice spills as contained in Section IV.A.1.a. of the Sale 100 FEIS (USDOI, MMS, 1985d) is incorporated by reference; a summary of this description, as augmented by additional material, as cited, follows. This section in particular addresses additional concerns for proposed Sale 97 related to oil spills in the ice conditions of the Beaufort Sea Planning Area. Many of the rate estimates for the oil-weathering discussion in this section have been calculated from the weathering model described in Payne et al. (1984b).

Note that in this discussion of spill behavior, cleanup of oil spills is not considered or assumed. It is likely that cleanup would be attempted, but historically at-sea cleanup has not been very effective. Success depends too greatly on local ice, oceanographic, and weather conditions; type and quantity of oil; logistics; and shoreline character. Readers are referred to Section III of this Appendix for a discussion of oil-spill-cleanup technology and its effectiveness.

Pipelines pose the greatest spill risk to the study area. For the proposal and deferral alternatives, 62 percent of spill risk is derived from pipelines and 38 percent from platforms. For the cumulative case, 60 percent of spill risk is from pipelines, 38 percent from platforms, and 2 percent from tankers. A pipeline spill would almost always be a subsurface spill. Most platform spills--because platform spills are much more likely to occur during production than during exploration--and tanker spills would occur as surface spills. Spills from all three sources--pipelines, platforms, and tankers--are more likely to be of crude oil, but could also be of fuel oils. In the OCS, 7 of 12 platform spills of 1,000 barrels or greater were of stored oil, either stored crude or fuel oil. Stored-oil spills could be as large as blowout spills. For example, preliminary plans for the Endicott Reservoir development called for storage of 50,000 barrels of diesel for potential placement in the pipeline in case of shutdown (crude oil could congeal in the pipeline).

A winter spill that resulted from the proposed action would most likely be into moving pack ice. Most of the proposed sale area contains pack ice, the previously unoffered Chukchi Sea portion of the proposed sale area has little landfast ice, and most undiscovered resources are thought to be in deeper waters.

A. Surface Spills

Oil spills spread less in colder waters than in temperate waters because of the increased viscosity of the oil. Offshore of northern Alaska, an oil spill would spread less than in temperate waters, remaining 100-fold thicker than a slick in a more temperate climate. A spill of 10,000 barrels in open water in the Beaufort Sea might physically cover 1 to 2 square kilometers of surface and a spill of 100,000 barrels less than 10 square kilometers of surface (Table C-1).

The oil spill, however, would not long remain as one contiguous slick over such a small area. Winds in excess of 4.4 meters per second will cause a

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slick to break into windrows. Waves, movement of the slick, and changes in winds and ocean currents all tend to spread the slick discontinuously over the ocean surface. In open water in the Beaufort Sea, within 10 days the slick could discontinuously spread over an area 10- to 100-fold greater than the area of actual oiled surface. As weathering and spreading forces continued, the oil would separate further into individual tar balls or pancakes.

The composition of the oil affects just how an oil slick would weather. Composition and resulting characteristics of known North Slope and Beaufort Sea crudes vary considerably, but generalizations can be made. Evaporation of volatile components accounts for the largest percentage loss from most crude-oil spills, on the order of 25 percent within the first 24 hours. Over the life of an oil slick, evaporation accounts for about one-sixth to two-thirds of slick mass. For an oil such as Prudhoe Bay crude, with a high resid content, only about 9 percent of a spill would evaporate in 1 day at 0°C and a 5-meter-per-second (10-knot) wind (calculated from Payne, 1984a). Higher wind speeds or warmer temperatures would increase the initial rate of evaporation but would not appreciably increase the percentage of slick mass that eventually escapes into the atmosphere. Volatile components total only 17 percent of Prudhoe Bay crude.

A spill of diesel fuel would behave similarly, but diesel is missing both the most volatile and least volatile components found in crude oil. Under the conditions assumed above for a Prudhoe Bay crude, a light diesel would initially evaporate more slowly than the crude, on the order of 3.5 percent over the first day, but a larger overall percentage of diesel would eventually evaporate.

Competing with evaporation is dissolution, which chiefly involves the aromatic fraction of spill volatiles. Dissolution, however, is very slow compared to evaporation, with most volatiles usually evaporating rather than dissolving. Dissolved hydrocarbon concentrations underneath a slick, therefore, tend to remain low (see Sec. IV.B.14.a of this EIS). Over time, about 5 percent of a slick can be expected to dissolve.

Winds, waves, and currents break off oil droplets from a slick and mix them into the underlying water. The greater the turbulence, such as in a storm, the more rapidly oil is lost from the slick. Dispersion of oil droplets into the water, not dissolution, is the major mechanism for getting oil into the water column. Mousse formation (water-in-oil emulsion) slows but does not stop dispersion from a slick.

For an oil with a relatively small volatile component such as Prudhoe Bay crude, dispersion can be as important as evaporation in removing oil from a slick. Initial dispersion of Prudhoe Bay crude in the 10,000-barrel spill of Table C-1 would be 7.7 grams per square meter per hour. Dispersion would initially remove about 2.5 percent of the oil slick per day and about 13 percent over 10 days. Storm winds and waves could greatly increase dispersion rates.

At the same time that oil is being lost from the slick, the character of the slick changes. Many crudes, including Prudhoe Bay crude, form mousse. Most Canadian Beaufort Sea crudes, however, do not (Bobra and Fingas, 1985). For Prudhoe Bay crude, roughly 40 percent of the spilled oil could be expected to

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remain after initial weathering in the form of tar balls, pancakes, or mats. For arctic open waters, tar balls can form within days to within many months, depending upon weather, mixing energy, oil type, and availability of nucleation sites to initiate tar-ball formation (Payne, 1982, 1984b; MacGregor and McLean, 1977).

B. Subsurface Spills

Subsurface spills could occur from leaks through the seafloor pipelines or from subsea blowouts of wells. Blowouts or gathering-pipeline spills would disperse small oil droplets and entrained gas into the water column. A trunk pipeline--with gas removed--would emit only oil droplets.

Most of the oil would rise rapidly to the water surface to form a slick. Droplets less than 50 microns in size, a category including about 1 percent of total spill volume, could be carried several kilometers down-current before reaching the water surface. Buist et al. (1981) found that 90 percent of the oil reached the surface in a 50-meter radius about the discharge point in a simulated, subsurface gas-and-oil blowout at a 20-meter water depth in the Canadian Beaufort Sea.

The release of oil droplets would allow some increase in the dissolution of oil, but the rapid rise of most oil to the surface suggests that this increase in dissolution must be fairly small. Oil that reached the surface would weather and behave similarly to a surface spill.

C. Summer Broken-Ice Spills

Most of the acreage of proposed Sale 97 is covered by pack ice in summer. Therefore, a summer spill would most likely be into first-year or multiyear broken ice.

An oil spill in broken ice would spread between ice floes into any gaps greater than about 8 to 15 centimeters (Free et al., 1982). A large, instantaneous spill would push loosely packed ice floes away from the spill, creating a larger gap at the spill site. In more closely packed ice--because fresh crude oil is less dense than sea ice--crude oil would have a tendency to overflow rather than underflow ice (Thomas, 1983). Any waves within the ice pack would also tend to pump oil onto the ice. Approximately 25 percent of the oil spilled in pancake ice would be present on top of the pancakes because of this pumping (Stringer and Weller, 1980). More viscous and/or weathered crudes may adhere to porous ice floes, essentially concentrating oil within the floe field and limiting the spread of oil. Such concentration was observed in the Ethel H. (Deslauriers, 1979) and Kurdistan (Reimer, 1981) spills.

Initial spillage could entrain some oil on the underside of the ice floes; however, because of its buoyancy, most oil would remain in the water between floes. Differences in velocities of ice and underlying water would have to be on the order of 15 to 25 centimeters per second to move oil along the underside of first-year ice (Cox and Schultz, 1981). Velocities would have to be greater than 20 centimeters per second to move oil underneath the rougher

3

relief of multiyear ice. Strong surface currents are found at times in the Beaufort Sea Planning Area, and differential velocities of such magnitude are possible.

In broken, first-year ice, brine channels would allow relatively rapid movement of oil from underneath the ice to the ice surface. A maximum flow rate of about 0.4 millimeters of oil per hour through decaying first-year ice has been calculated by Thomas (1983). Any oscillation of the ice--wave action, slight uplifting of floes in collisions, overturning, or tilting that results from uneven melting--also tends to remove oil from underneath the ice. Multiyear ice does not contain continuous brine channels. Release of entrapped oil from multiyear ice would be slower than from first-year ice, but would still occur.

Oil between or on ice floes is subject to normal evaporation. Some additional dispersion of oil occurs in dense broken ice through the grinding action of floes (Reimer, 1980). This grinding action, however, also greatly promotes mousse formation. Prudhoe Bay crude, for example, forms a mousse within a few hours in such circumstances, an order of magnitude more rapidly than in open water (Payne, 1984).

D. Winter Under-Ice Spills

A winter spill under unbroken landfast ice or pack ice would most likely have to be a pipeline spill. The oil would rise to the underside of the ice in a manner similar to that described earlier for a summer pipeline spill rising to the water surface.

The spread of oil along the underside of the ice is controlled by several factors. Separate oil droplets or small pools on the order of 0.2-millimeter thickness will not coalesce or flow into hollows underneath the ice (see Buist et al., 1981). About 2 millimeters of oil could be accommodated in the skeleton layer of ice crystals beneath the solid-ice layer. Thicker layers of oil tend to coalesce or spread under the ice until an equilibrium thickness of 0.8 centimeters is reached (Rosenneger, 1975). If a sufficient volume of oil were instantaneously spilled, oil would spread into hollows underneath thinner areas of ice. Such hollows in first-year ice of late winter could store 150,000 to 300,000 barrels of oil per square kilometer (Stringer and Weller, 1980). Multiyear ice, which is rougher, could store 1.8 million barrels per square kilometer in under-ice relief (Kovacs, 1977).

More than 90 percent of the proposed sale area lies in the pack-ice rather than the landfast-ice zone (Roberts, 1986). A spill into winter ice would, therefore, be more likely into multiyear pack ice than landfast ice. The greater storage capacity of multiyear ice would not be well-utilized in a real spill situation because of the movement of the ice over the spill.

A pipeline spill of 1,000 to 25,000 barrels per day might be spread as a ribbon, approximately 100-meters wide, and 0.3 to 8 millimeters thick, on the underside of the moving pack ice. Spills of greater size would pool within the ribbon, into hollows on the underside of the ice. Only a spill rate greater than 900,000 barrels per day would fill the underside storage capacity of the ice and result in a somewhat wider ribbon. The length of the ribbon would depend on the duration of the spill; and the ribbon would grow at the

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speed of ice movement, usually about 5 kilometers per day in the Beaufort Sea Planning Area (see Sec. III.A.3.a of this EIS). Faster movement of the ice as may occur in a storm would result in a longer, but thinner, ribbon of oil.

Differential velocities between ice and underlying water need to be greater than 20 to 25 centimeters per second to move oil out of hollows on the underside of winter pack ice. Such velocities are possible in the Beaufort Sea Planning Area. Even in the presence of such differential velocities, oil would not likely move more than a few kilometers from its original location on the underside of the ice. New ice would form beneath the under-ice oil within 5 to 10 days, isolating it from currents and further weathering. Grease ice and also slush ice beneath the ice cover should retain spilled oil and limit its spread and movement (Martin, 1981; USDOC, NOAA, and USDOI, MMS, 1985).

Because of these and other factors, a winter spill (or whatever part of a winter spill that is not cleaned up) will become a fresh, unweathered spill when the ice melts.

To get into the water of a lead or a polynya earlier than breakup, oil would have to be spilled in a polynya or a polynya would have to form through the ice-entrapped spill; that is, it would have to break the ice in the middle of the frozen spill. If such breakage occurred in the latter case, appreciable quantities of oil could not be released unless breakage occurred through a relatively rare, thicker pool of oil. Such pools would be isolated and small; therefore, only minimal quantities of oil would be released into the forming polynya.

Oil released into the polynya would be blown to its downwind edge, where it would accumulate in a band. The oil would then be either frozen into the ice or contained behind accumulating brash ice (floating ice made up of fragments not more than 2 meters across). It it possible that the cold, saline water formed as the polynya freezes could incorporate relatively high concentrations of dissolved hydrocarbons into a sinking plume of denser water. This plume would then spread out at some equilibrium depth in deeper water as a relatively stable and distinct layer (see Sec. IV.B.14 of this EIS).

In the Beaufort Sea Planning Area, oil would start melting out of first-year ice in June; oil spilled earlier in winter would melt out earlier. Oil in multiyear ice would be released more slowly, perhaps 1 to 3 months later, with 10 percent of the oil taking more than 1 year for release.

E. Winter Broken-Ice Spills

The most likely winter spills from tankers (cumulative case only) or platforms in the proposed Sale 97 area would be spills into broken pack ice. Spills from platform-stored oil would collect in open water or broken ice in the lee of bottom-founded production platforms. Tanker-spilled oil would collect in open-water leads, cracks, and the broken-ice channel left by a tanker along its track (Marsh et al., 1979; Jordan and Payne, 1980). The tanker track would refreeze within hours during the months of November through June (Roberts, 1986).

Blowouts provide a mixed mode of spillage. A subsea blowout would place oil into the broken ice in lee of the platform. The subsequent winter fate of the spilled oil would be similar to that of a subsea-pipeline leak under ice. A surface blowout would place oil into broken ice and on top of rather than underneath the ice. Such surface release would likely result in appreciable, but incomplete, evaporation of volatile hydrocarbons prior to breakup. Thus, a surface blowout--or any other spill on top of the ice--would be partially weathered during winter.

The bulk of oil spilled into winter broken ice would be rapidly frozen into the pack ice. Because the oil would be frozen into new ice, brine channels would be present and would allow most oil to be released during breakup.

II. EXTENT AND PRESISTENCE OF OILED SHORELINE

If an oil spill occurs and contacts shore, two important but nonbiological questions arise: (1) how much shoreline will be contaminated and (2) how long will the contamination persist? In winter, landfast ice along the shorelines of the Beaufort and Chukchi Seas would keep spills offshore, away from the shoreline, and any oil that did reach shore would not penetrate into the frozen beach. For these shorelines, the relevance of these questions is much greater for the spills during the open-water season than for spills during the winter.

A. Extent of a Shoreline Spill

An offshore spill that reaches shore is not likely to reach the shoreline in its entirety; contact could occur with the shoreline in several locations, or the spill could be "smeared" along a single location depending on the nature of winds and longshore current. How long a stretch of coastline could be coated by an oil spill is difficult to quantify but can be estimated on the basis of study by Ford (1985).

Ford used multiple regression and case histories of 39 spills in which coastline was oiled to develop empirical equations predicting how much coastline would be oiled if oiling occurred. (Note that not all spills reach shore.) Ford found that an equation estimating oiling as a function of only the volume spilled accounted for 59 percent of the variance in the historical record. An equation estimating shoreline oiling as a function of volume and latitude was a slightly more precise estimator, accounting for an additional 6 percent of the variance. Wind speed, water temperature, and wave height did not significantly correlate with the amount of shoreline oiling.

The Equation 13 (Table 4 in Ford, 1985) relating shoreline oiling to volume alone is a more appropriate predictor than the equation relating oiling to both spill volume and latitude. Obviously, increasing latitude would not directly cause a spill to spread over more shoreline. The correlation with latitude must be an artifact caused by a secondary relationship such as an increase in shoreline complexity as latitude increases. However, the historical spill record used by Ford encompassed only a relatively narrow range of latitude; and the unidentified, indirect relationship should not be assumed to continue outside of that range.

Based on Equation 13, if a spill of 10,000 barrels occurred and contacted land, about 30 kilometers of coastline could be expected to be oiled. For a spill of 100,000 barrels, expected oiling would be on the order of 90

kilometers. However, it would be possible for a spill to contact severalfold longer or shorter stretches of coastline than these averages or, alternatively, not contact any shoreline at all.

Long-duration spills are depicted less precisely in the oil-spill-risk analysis than are instantaneous spills. The oil-spill-risk analysis can still be used to represent the relatively rare occurrence of a long-duration spill as discussed in Section IV.A.2 of the Sale 100 FEIS (USDOI, MMS, 1985d). This discussion is incorporated by reference, and a summary follows.

For such spills, the center of mass of the spill is still depicted accurately. However, the spreading of the oil over different trajectories through time would result in more frequent contacts of oil with land, but each contact would involve only a fraction of the total spill. For such spills, the conditional probabilities of contact from an individual hypothetical launch point represent the fraction of the total spill that would contact that target or land segment, disregarding weathering and cleanup. (The conditional probability would normally represent the likelihood that the target or land segment was contacted by the entire spill.)

Note, however, that there are additional constraints on the degree of oiling of any specific stretch of shoreline. These constraints are discussed in Section IV.A.1.d. of the Sale 87 FEIS (USDOI, MMS, 1984a). This discussion is incorporated by reference; a summary follows. The tidal range for this region is quite low (10-30 cm average), and habitats such as marshes or delta tidal flats would have to be inundated by seawater during a storm surge to allow appreciable inland stranding of oil. These dual restraints on stranding of oil reduce the likelihood and degree of oiling to such habitats to less than that implied by probabilities from the oil-spill-risk analysis.

B. Persistence of Stranded Oil

The oil-retention characteristics of shoreline along the U.S. Beaufort Sea coast are described in Section IV.A.1.d. of the Sale 87 FEIS (USDOI, MMS, 1984a). This description is incorporated by reference; a summary follows. A discussion of persistence necessarily relates to that oil remaining after cleanup or to situations where cleanup could cause more damage than would the original spill if it were left in place. Marshes; low tundra shores; and low, vegetated barriers, which together form most of the Beaufort Sea coast, may be areas where most cleanup operations--removal of contaminated soil and vegetation or even heavy foot traffic--could cause permanent scars in the landscape and ecosystem. Newer techniques, such as low-pressure hosing coupled with clipping of oiled vegetation, provide both ecologically and technologically sound means of cleaning some of these areas. Thus, cleanup is a viable option to mitigate problems caused by shoreline oiling and oil persistence.

Persistence of oil on various types of shorelines has been investigated both experimentally through small, deliberate spills on test plots and by monitoring oil persistence following accidental spills of various compositions and magnitudes. In these studies, the persistence of oil is always highly correlated with shoreline type, largely because of the importance of physical processes in both weathering and natural removal of oil.

Based on these empirical data, several studies have rated the oil-retention potential of the coastline bordering the Beaufort Sea Planning Area. Most of the Beaufort Sea coast is considered to have moderate to high retention potential, with less than half of the coast in the high category. Stranded oil, if not cleaned up, and if in a zone of high oil-retention capacity, could persist for decades along at least part of the oiled shoreline. In many locations, persistence would be less because of the rapid rate of retreat of much of the Beaufort Sea coast; stranded oil would be eroded along with the shoreline.

III. OIL-SPILL-CONTINGENCY MEASURES

The description of the Federal framework for oil-spill response as contained in Allen et al. (1984) is incorporated by reference; a summary of this description, as augmented by additional material, as cited, follows. The bottom line for OCS oil-spill response is that cleanup is the responsibility of the spiller. The Federal Government will step in only if the Government considers the spiller's response to be inadequate. The basic philosophy of both the Government and the oil and gas industry is to prevent spills before they happen. Considerable attention is given to preventive measures such as better technology and better training. However (as with many systems)--because there is a chance of human error or unforeseen incidents--secondary measures that would be taken if an oil spill occurred must be considered.

A. Contingency Plans

The Alaska Beaufort Sea Oilspill Response Body (ABSORB) is expected to expand its coverage to include any leases from the proposed sale area prior to exploration, as has been the case elsewhere along the arctic coast of Alaska. The ABSORB area of interest is currently defined as follows (Alaska Clean Seas, 1984):

> "The public and private properties, including but not limited to beaches, harbors, inland waterways, and offshore islands and water along the coast of the State of Alaska, within the area bounded on the east by the Canadian border, on the west by 156 degrees W. longitude, on the south by the mainland shoreline of the State of Alaska, and on the north by the sixty meter isobath."

ABSORB is part of the umbrella organization, Alaska Clean Seas, which is a State-wide cooperative. Alaska Clean Seas is divided into cost participation areas (CPA's); ABSORB makes up one CPA. Each CPA is established on the basis of physical conditions that favor the use of similar oil-spill-recovery techniques and equipment, in addition to proximity to a staging area for oil-spill-recovery techniques. Spill-response equipment, training, and research of Alaska Clean Seas is available to all CPA-member companies. Alaska Clean Seas also has agreements in place with other industry cooperatives for the loan of equipment during a spill situation.

Alaska Clean Seas has compiled an oil-spill-contingency-planning manual, an oil-spill-response-considerations manual, and a biological resources atlas for the ABSORB CPA (Alaska Clean Seas, 1984, 1983a, 1983b). Lessees are required to develop oil-spill-contingency plans as part of their exploration plans prior to drilling. More than a dozen oil-spill-contingency plans have been submitted and approved to date for exploration of existing leases in the Beaufort Sea Planning Area. By having on hand prior knowledge of the nature of the spilled material, slick dynamics, and the characteristics of the threatened environment, plus available equipment and manpower, the responsible party can order and evaluate selected actions. These evaluations include consideration of the habitats that are most vulnerable to damage from oil spillage or from the cleanup operation itself.

Responses to spills from OCS activities are approached by arranging and ranking lines of defense to prevent spilled oil from affecting identified vulnerable environment. The first line of defense is always offshore containment. Open-water collection of spilled oil (without containment) is usually not successful (see Sec. III.E below). Containment is useful in stopping the spreading of the oil and in providing extra time for deployment of more equipment and manpower. In the presence of sea ice--which can act as a natural containment barrier--in situ burning may be an effective treatment. For a blowout, well ignition is a drastic but potentially effective contingency measure. If conventional cleanup equipment cannot recover the oil before spill contact with important resources is likely to occur, it may be appropriate to use chemical agents to disperse the slick, if permission for their use can be obtained. The Regional Response Team in Alaska, chaired by the U.S. Coast Guard and the Environmental Protection Agency, is trying to streamline guidelines and gain partial preapproval for using dispersants in some Alaskan waters.

A second line of defense entails the booming of major inlets and the closure of washover channels and small inlets. Next, the defense uses booms to concentrate on preventing oil from entering enclosed waters of bays and lagoons where sensitive resources may occur. Finally, small channels that feed marshes and tidal-flat systems are boomed or closed, entrance ways to small bays and coves are boomed, and deflection booming is used to protect fringing marshes and other sensitive environments.

B. Locally Available Spill-Cleanup Equipment

The MMS Alaska OCS Region requires a lessee who wishes to drill to have an initial spill-response capability of 1,000 barrels per day. To date, during drilling of exploration wells in the Beaufort Sea, this requirement has been met with equipment warehoused at Deadhorse by ABSORB and with equipment positioned on site by individual lessees. Table C-2 lists the detection and recovery equipment of the ABSORB at Deadhorse. Additional equipment is maintained by individual U.S. companies on the North Slope and by Canadian companies and the Canadian Beaufort Sea Oil Spill Cooperative at Tuktoyaktuk, NWT (Table C-3). Note that offshore production has not yet started in the Beaufort Sea, although the Endicott Field will soon be on line. If commercial quantities of oil are discovered in the Sale 97 area, additional spill equipment will likely be stockpiled, either by ABSORB or by the field owners.

Table C-4 provides an example of on-site capabilities, listing equipment provided on site (in this case on the drillship) by Canmar and Union Oil of California during the drilling of a Sale 87 lease in the summer of 1985. "On site" means stored either on the drilling platform, drilling-rig supply vessel, and/or the standby workboat. On-site equipment is typically capable of handling small operational spills of 50 barrels or less (Hooks, McCloskey

and Associates, Inc., 1984b). Larger spills would require mobilization of additional equipment.

C. Mobilization Time

The MMS Alaska OCS Region requires initial mobilization and deployment of response equipment within 6 to 12 hours of a spill, geography permitting. However, the spiller must be prepared to respond before the spill reaches shore (in less than 6 hours, if necessary). This initial timeframe is for relatively small spills, although MMS has not specifically defined size. Only on-site equipment and that which could be transported from Deadhorse by helicopter could meet this guideline for deployment for most of the sale area. The limited geographic and temporal presence of open water and slow vessel speeds in broken ice (see Fig. C-1) would preclude timely transport of spill equipment by sea. For larger spills--those that could exceed the local cleanup-response capability--the MMS Alaska OCS Region requires that additional equipment be made available on site within 48 hours.

Additional response equipment to handle a large spill would be available from a multitude of sources. Many of these sources and their equipment lists have been inventoried for potential use in the Beaufort Sea, in Alaska Clean Seas (1984), and in the individual oil-spill-contingency plans of lessees. Estimated response times for mobilization and transport of equipment to Prudhoe Bay from these additional sources are given in Table C-5 for air transport and in Table C-6 for sea transport. Equipment stored in Anchorage could also be trucked to Prudhoe Bay within 32 to 40 hours, not including mobilization and loading/unloading times. Mobilization and air-transport times needed to airlift spill-cleanup equipment to Deadhorse would range from 4 to 13 hours from sources in Alaska and on the Pacific Coast. Sea transport from Alaskan and other U.S. ports to Prudhoe Bay would not be possible without icebreaker support except during a brief period of relatively open water in late summer (see Fig. C-1).

Equipment would be more rapidly and readily available from the Canadian Beaufort Sea area. Flight time for a C-130 between Deadhorse and Tuktoyaktuk would be about 1 hour. Equipment could be shipped from the Canadian Beaufort Sea over a period of 2 to 3 months. U.S. Customs regulations would not interfere. Spill equipment to be used in the proposed sale area would require only a courtesy call to U.S. Customs, who should be notified before equipment is brought within the 3-mile limit, unless true emergency conditions exist. In the latter case, U.S. Customs will accept after-the-fact notification (Union Oil Company of California, 1985).

Equipment stored at Deadhorse or airlifted to Deadhorse would be capable of meeting the criteria of the 48-hour-response time set by MMS. Additional, slower-arriving equipment would still be useful in case of a major spill; but MMS would not consider such equipment in judging whether oil-spill-contingency plans met the MMS 48-hour-response criteria.

Once spill-cleanup equipment reaches Deadhorse or Prudhoe Bay, it could be transported relatively quickly to the spill site only if it could be carried by helicopter and then only if weather permitted. A helicopter could reach any point in the sale area within 3 hours. Pack ice would prohibit ship transport other than by icebreaker over most of the proposed sale area for

most of the year, including summer. Land-vehicle transport of spill equipment would not be safe across appreciable distances on pack ice.

D. Effectiveness of Oil-Spill Cleanup At Sea

The 6-to-12-hour and 48-hour response times required of drilling lessees by the MMS Alaska OCS Region are mobilization and deployment requirements. Cleanup would continue as long as necessary, without any timeframe or deadline. For example, a winter spill in pack ice might require initial on-site response followed by further cleanup of oil melting out and pooling on top of the ice in late spring or summer. For the purposes of environmental assessment of offshore oil and gas lease sales, the MMS usually considers mitigation of major oil spills through cleanup to be possible through the tenth day of a spill, after which the oil would be too dispersed for effective recovery. Analyses in EIS's for MMS oil and gas lease sales usually concentrate on this timeframe, as does the analysis of summer spills in this EIS. A winter spill, however, would freeze into the ice and remain relatively intact until it melted out. Such a spill would behave as a fresh, early summer spill.

Mechanical cleanup at sea is usually much more effective on low-viscosity oil or medium-viscosity oils than on high-viscosity oils (Fig. C-2). A low-viscosity oil could be a diesel or fresh, light crude. A medium-viscosity oil could be a lubricating oil or a light, flowing emulsion. A high-viscosity oil would be a weathered crude, bunker oil, or thick emulsion. An oil such as Prudhoe Bay crude would initially have low viscosity, but would quickly weather and form an emulsion. In the presence of sea ice, this transformation may take as little as 4 hours (Payne, 1984); in the absence of sea ice, perhaps 2 days (Payne et al., 1984a). For the example in Table C-1, based on the weathering model of Payne et al. (1984b), Prudhoe Bay crude would weather into a high-viscosity oil within 4 hours of spillage. The effectiveness of most forms of mechanical recovery of the crude would decrease twofold over this 4-hour period.

Oleophilic-rope recovery systems are a relevant exception to this twofold decrease in oil-recovery rate with increasing oil viscosity. The ABSORB has emphasized such devices in its contingency strategy, including development and deployment of the oleophilic-rope skimmer, the ARCAT II. Oleophilic-rope systems at medium international sea states, between Sea State 1 and Sea State 3, can recover high-viscosity oil more readily than lesser-viscosity oils. At lower sea state, highly-viscous oils can be recovered at 69 percent of the rate for low-viscosity oils (S.L. Ross Environmental Research Ltd., 1983a).

Chemical dispersion--the use of dispersants to mix the oil into the water rather than attempt to recover the spilled oil--is an alternative technique to mitigate spill damage. Dispersants lose effectiveness even more rapidly than mechanical recovery as oil weathers and becomes more viscous (see Fig. C-2). Oils with in situ viscosities greater than 2,000 centistokes cannot usually be dispersed (The International Tanker Owners Pollution Federation, Ltd., 1982a,b). Based on the weathering model of Payne et al. (1984b), under the conditions in Table C-1, such viscosities would be reached by Prudhoe Bay crude about 8 hours after spillage. In the presence of sea ice, the rapid formation of mousse could preclude effective use of dispersants in even a

shorter period of time. Best use of dispersants obviously occurs when they can be applied immediately after the spill has occurred (or near the point of spillage for a continuing spill).

Use of dispersants to treat an oil spill, however, requires the On-Scene Coordinator to have the concurrence of the EPA representative to the Government Regional Response Team (RRT) and also the concurrence of the State's representatives. Historically, such permission has been difficult if not impossible to obtain. The reason for this difficulty lies in the perceived toxicity of oil-dispersant mixtures, questions as to the effectiveness of the dispersant, and because dispersants remove oil only from the surface of the water and not from the water environment. Detailed information on the effectiveness of a specific dispersant on a specific spilled oil as a function of air and water temperature, dispersant concentration, and age or weathered state of the slick--as well as detailed information on the proposed dispersantapplication system--are necessary for an informed RRT decision on dispersant use. Such parameters would be known when any spill-contingency plans were written for production, and approval for dispersant use would be more likely during production than has been the case during exploration. The RRT, for example, has released draft guidelines for dispersant use in Cook Inlet.

The RRT, the American Society for Testing and Materials (ASTM), the National Academy of Sciences (NAS), and ACS are all, separately, considering the establishment of dispersant-use guidelines or manuals for Alaskan or in arctic waters.

Because of natural dispersion, oil slicks in the open ocean are seldom tracked for more than about 10 days before the oil becomes too dispersed to locate or identify as a slick. Out of necessity or otherwise, natural dispersion has frequently been the chosen response technique in Alaskan waters. The F/V Ryuyo Maru No. 2 grounded off St. Paul Island in 1979. Fuel oil on board could not be safely removed, and the vessel was deliberately blown up at a time when weather would maximize natural dispersion (Reiter, 1981). In Kuskokwim Bay in the summer of 1982, the Cornell Barge No. 8 sunk, spilling some but not all of its load of fuel oil. The remaining fuel oil was deliberately released and allowed to disperse by the Coast Guard. Accidental and deliberate release totaled 2,190 barrels over 3 weeks (Oil Spill Intelligence Report, 1982). The observed slick extended no more than 1 kilometer from the barge, indicating a slick life of no more than a few hours. The tanker Cepheus grounded in Anchorage Harbor and spilled 5,000 barrels of fuel in January 1984. Because of the presence of broken ice in surrounding waters, the spill could not be tracked and no cleanup occurred away from the tanker, but no slick was ever found.

Oil spills do not always disperse this rapidly or completely. Generally, the more asphaltic the oil, the larger the spill, the calmer the water, and the more restricted the water body, the longer a spill will persist. Note, however, that the long durations of many of the "classic" historical spills are as attributable to the persistence of the spilling event as to the persistence of spilled oil. Oil spilled from the Arco Merchant for a month, for example, and the Ixtoc I blowout continued for 9 months (National Academy of Sciences, 1985).

Uncontained burning is also a possible spill remedy. Experiments suggest that burn efficiencies on the order of 50 to 60 percent may be possible if the spill can be immediately set on fire (Laperriere, 1984). However, any delay in ignition would decrease combustion efficiency.

The effectiveness of mechanical recovery and in situ burning of spilled oil at sea decreases rapidly with increasing sea state (roughness of the sea), while the effectiveness of dispersants and natural dispersion increases. Mechanical cleanup becomes nonfunctional between International Sea States 3 and 4 (S.L. Ross Environmental Research Ltd., 1983a). During the months of July through September in the small fraction of the Beaufort Sea Planning Area with open water, Sea States of 3 or greater occur from 13 to 30 percent of the time; and Sea States of 4 or greater occur 9 to 18 percent of the time (Fig. C-3). Ice cover the remainder of the year would eliminate both high sea states and standard uses of most mechanical-cleanup equipment.

In real spill situations, optimum efficiency of cleanup equipment, expressed in Figure C-2, is seldom reached. To some extent, bad weather, equipment failures, and personnel problems can be factored into estimates of cleanup efficiency in oil-spill-contingency plans. In practice, such estimates are usually found to be overly optimistic. Spill cleanup generally requires unexpected modification of procedures and equipment. Equipment or people often do not work as well as hypothesized.

The MMS Gulf of Mexico OCS Region (USDOI, MMS, GOM, 1983) reviewed the historical record of oil-spill cleanup at sea and concluded that such cleanup is usually not very efficient:

> "Offshore containment/cleanup operations are generally a major task requiring significant coordination and cooperation, transportation of large equipment, vessel support, aircraft support, set-up and maintenance of a command/coordination post in the field, and properly staged and available equipment. Often, the weather/sea conditions and crew fatigue become the critical factors during offshore operations. The effectiveness of containment/cleanup operations offshore are, in general, marginally effective. It is possible to contain a platform spill if environmental and logistical conditions are right; however, it has been found through experience that conditions are rarely ideal and full containment of a platform spill is not likely. The effectiveness of this type of containment and cleanup operation is estimated to be approximately 5 percent to 15 percent recovery.
>
> "Inshore containment/cleanup operations can be either large-scale or moderately sized operations depending on any particular spill situation. Again, if the task becomes large it requires the same level of coordination and support as an offshore operation. The effectiveness of a containment/cleanup operation in an inshore area largely depends on the unique physical characteristics of the environment and the area of the operation. Beach cleanup is normally effective utilizing hand labor, organic sorbents, and a wide variety of tools from rakes to bulldozers. Utilizing booms and skimmers, containment of a spill moving into an inlet is marginally successful depending almost entirely on the physical characteristics of the inlet. Containment and cleanup in marshes is very controversial. Modern opinions often lean towards the 'NO ACTION' strategy for fear of cleanup operations causing even more damage. The effectiveness of inshore containment cleanup operations can often be much greater than offshore operations. Effectiveness is estimated to be 20 percent to 50 percent containment and cleanup of material moving into the area."

E. Effectiveness of Oil-Spill Cleanup in Ice

When a spill is dispersed far from its source or when ice is moving, containment and cleanup are more difficult. Planning an effective surface response with mechanical equipment to spills in pack ice would require that an icebreaker (or icebreaking-supply ship) be locally stationed in both winter and summer as a dedicated oil-recovery vessel (Tebeau, 1984). Icebreakers are expected to be present in the proposed sale area during both exploration and production. An appropriate example of such operations would be the exploration drilling conducted by a drillship on Sale 87 leases in the summer of 1985. The drillship was accompanied by an icebreaker and two ice-capable supply ships that "managed" the ice at the drill site.

In situ burning of spilled oil during heavy ice periods may be a more promising approach. Buoys or other markers would be placed on the the ice to track under-ice spills. Exposed oil would be ignited whenever possible.

Existing response capabilities are more effective on landfast ice than on broken or pack ice. Spills on top of landfast ice can be cleaned up fairly easily as long as oil is not pooled to sufficient depth (on the order of several centimeters) to crack the ice and allow some of the oil to flow underneath the ice (Shell Western E&P, Inc. et al., 1984). About 5 centimeters of Prudhoe Bay crude, or about 300,000 barrels per square kilometer, could be supported by mature, first-year ice without seepage of oil underneath the ice.

Cleanup effectiveness for oil under landfast ice has been measured by Buist et al. (1981). Buist et al. conducted three simulated undersea blowouts totaling 119 barrels under landfast ice in the Canadian Beaufort Sea. The following spring, as the oil rose to the surface and pooled on the ice, as much oil as possible was burned or manually recovered. Cleanup efforts ceased only when breakup occurred and the remaining oil naturally dispersed. A total of 125 burns were conducted, more than one burn for each barrel of oil spilled. Overall burn efficiency averaged 51 percent, with average burn efficiencies ranging from 18 to 77 percent in the three spill experiments. An additional 28 percent of the oil (range of 14 to 51 percent) was manually recovered. The manual cleanup was labor-intensive, requiring 0.7 man-days per barrel or 350 man-days per square kilometer. Overall, 79 percent (range of 67 to 88%) of the weathered oil was burned or manually recovered.

Spills in broken or moving ice would be more difficult to handle. The greatest success would be expected when the spill is contained within a small area close to the source of the spill. The ice itself may useful in restricting the spreading of the oil, keeping the oil thicker and more amenable to burning.

Oil melting out of pack ice would be much more difficult to burn than oil in the Buist et al. (1981) study. Oil would melt out of pack ice much more slowly than from landfast, first-year ice; some oil would even take a second summer to reach the top of the ice (see Sec. I of this appendix). In addition, a stationary but continuing spill could spread a ribbon of oil underneath many or even hundreds of kilometers of pack ice. The manufacture, shipment, temporary storage, and deployment of the thousands, or perhaps tens of thousands, of igniters necessary to effectively attack a major spill is a logistical nightmare.

Burning experiments in broken ice have given promising results with fresh oil, but results have been variable and less promising with weathered oil and emulsions. Field tests in a mud pit at Prudhoe Bay were able to burn 55 to 85 percent of fresh Prudhoe Bay crude, but sparged crude with a flash point of over 30 °F could not be ignited (Shell Oil Company et al., 1983). Tests at OHMSETT for fresh or sparged crude had burn efficiencies of 85 to 95 percent at 22- to 34-percent ice cover and burn efficiencies of 58 to 79 percent at 78- to 85-percent ice cover. Burn efficiencies of 2 tests for oil-in-water emulsions were only 10 to 52 percent at 78- to 84-percent ice cover (N.K. Smith, unpublished, 1985). Some oil burned against retaining barriers in both the field and OHMSETT tests; and the efficiencies are somewhat higher than could be expected for a true, uncontained burn in broken ice. Payne (1984) found that emulsification is accelerated in broken ice (occurring within 4 hours), indicating that a slick would have to be set on fire very soon after spillage in order to obtain a high burn efficiency.

It may be more difficult to burn spilled oil during freezeup than at any other time of year. Martin (1981) has shown that wave action mixes the oil downward into the grease ice. Oil and ice would have to be recovered and the oil separated from ice before burning; there would be only a limited capability for in situ burning.

Partly because of oil-spill risks during broken ice, the State of Alaska has applied two sets of seasonal drilling restrictions in State waters of the Beaufort Sea. Tier-I regulations prohibit drilling during periods of broken ice, during some periods of open water for locations outside the barrier islands, and during the fall bowhead whale migration and freezeup for locations outside the barrier islands. Tier-II regulations allow unrestricted drilling in State waters, with the exception of locations outside the barrier islands during the fall bowhead migration and freezeup. The Tier-II level applies on to "lessees who demonstrate compliance with applicable laws and regulations, including the theoretical and physical capability to detect, contain, and clean up and dispose of spilled oil in broken ice conditions" (see Shell Oil Company et al., 1983).

In 1983, several oil companies participated in a review of applicability of current cleanup techniques to broken-ice conditions (Industry Task Group, 1983) and field demonstrations of capabilities during breakup of landfast ice (Shell Oil Company et al., 1983). A third report (Shell Western E&P, Inc. et al., 1984) provided additional technical documentation of review and demonstrations and constitutes a state-of-the-art manual for cleanup during breakup of landfast ice in the Beaufort Sea.

The cooperative review, the field demonstrations, and resulting reports considered only breakup conditions. Freezeup conditions were deemphasized because of the existence of a seasonal drilling restriction in State waters during the fall bowhead migration.

The State of Alaska had an independent consultant evaluate this demonstration of industry's capabilities (S.L. Ross Environmental Research Ltd., 1983b) and, based on that and its own analysis, granted Tier-II status to the participating oil companies. The conclusion of S.L. Ross Environmental Research Limited provides a concise summary of oil-spill-countermeasure capabilities of industry in broken-ice conditions:

> "The industry's technological capability is judged to be very good for removing oil discharged from a large oil well blowout occurring on a gravel island in the Alaskan Beaufort Sea during broken ice conditions (as well as during periods of landfast ice and open water); this is only the case if the blowout is ignited and/or combustion and skimming techniques take place in close proximity to the island. . . . Although industry's overall response capability for gravel-island oil well blowouts is very good (by virtue of oil burning procedures at or near the well-head) the fact remains that the capability to clean up large oil spills floating amongst moving ice is generally not good, particularly if the oil is thin and weathered."

In other words, industry can effectively clean up an oil spill in moving ice only if the spill is a platform blowout that can be set on fire without endangering platform integrity. If this is the case, the platform could still be used as a base for cleanup and well-control operations.

Table C-1
Spill-Size Examples for Summer Spills in Open-Water Portions of the Beaufort Sea Planning Area

Calculations are based on the oil-weathering model of Payne et al. (1984b). The examples are of a Prudhoe Bay-type crude, which is considered the best analog for undiscovered crude in the Beaufort Sea Planning Area.

Time After Spill	10,000-Barrel Spill 3 Days	10,000-Barrel Spill 10 Days	100,000-Barrel Spill 3 Days	100,000-Barrel Spill 10 Days
Open-Water Spill (August, 10 knots wind speed, 0 °C, negligible waves)				
Oil Remaining (%)	82	71	86	78
Thickness (mm)	1.2	0.6	2.6	1.4
Area of Slick (km^2) 1/	1.1	1.8	5.1	8.7
Discont. Area (km^2) 2/	26	120	85	400

1/ This is the area of oiled surface.
2/ Calculated from Equation 6 of Table 2 in Ford (1985). This is the discontinuous area of a continuing spill or the area swept by an instantaneous spill of the given volume.

Table C-2
ABSORB Equipment in Deadhorse 1/

ITEM	QUANTITY
DETECTION	
Gas/Oxygen Detectors	2
Gas Analyzer	1
Current Meter	1
Current Meter w/Recorder	1
Ice Augers	8
Orion Tracking System	1 system
Marker Stakes	1,000
Data Base for Trajectory Modeling	1
CONTAINMENT	
Goodyear Sea Sentry Heavy Duty	2,035 feet
Ocean Dike	5,400 feet
EPI Mini Boom	3,000 feet
American Marine Simplex	3,000 feet
Kepner Reel Pak	4,000 feet
Fire Containment Boom	2,500 feet
RECOVERY	
ARCAT II w/12-Man Life Raft	1
3M Sorbent Boom Type 280	250 bales
3M Sorbent Rolls Type 100	507 rolls
3M Sorbent Pads Type 151	269
3M Sorbent Pads Type 157	400 bales
3M Sorbent Type 356C	85 boxes
MI-30 Disc Skimmer	1
Weir Skimmer	10
214-F Rope Mop	10
Barracuda Rope Mop	1
MW 62 Rope Mop Skimmer	2
Trans-Vac with Manta Ray Skimmers	2
DISPOSAL	
Igniters	1,700
Dispersant	20 drums
STORAGE	
Firestone Fabritanks - 2,250 gallons	20
Firestone Fabritanks - 4,400 gallons	4
Trellecon Bladder	1
Dracone Barges - 2,400 gallons	4

ce: Alaska Clean Seas, 1984.

This is not a complete inventory.

Table C-3
Canadian Beaufort Sea Oil Spill Cooperative Spill-Response Equipment 1/
(Based at Tuktoyaktuk, NWT, May 1984)

CATEGORY	QUANTITY	DESCRIPTION
VESSELS	1	Carrier II sea truck (Twin 20 Merc)
	1	Carrier III jet boat (Twin 350)
	1	70-hp outboard
	1	Zodiac c/w 20 hp
	1	39-ft. deployment vessel, Carrier 5
	1	Hiab Model 20 crane on Carrier 5
	1	49-ft. deployment vessel, Neakoolik
Anti-Pollution Barge II	1	Barge, 216 x 49.5 x 9.6 ft. complete with but not limited to the following equipment:
	1	VEP skimmer
	1	Watson heater treater/upgrading
	1	5,000 bbl/day burner c/w boom
	1	Oil and water pumping system
DETECTION	10	Orion tracker buoys
	1	Receiver, Orion
	4	Argos buoys
CONTAINMENT	250'	Fireproof boom c/w ISO container
	2,400'	Arctic boom mod/77
	4,000'	36-in. Bennett Navy boom
	2,500'	18-in. Bennett inshore boom
	1,000'	36-in. Bennett Navy boom Ex Tarsiut
OIL RECOVERY	2	SLURP weir skimmers
	1	Lockheed R2003 skimmer
	1	6-in. oil mop skimmer
	5	Morris M130 skimmers
	2	Rope mop skimmer
STORAGE	10	Porta tanks
	3	10,000-gal. Uniroyal bladders
	16	1,100-gal. Canflex bladders
	1	Open-top Canflex bladder
TRANSFER	9	Pumps, various
	1	Oil separator
	1,150 ft.	Hose
OIL DISPOSAL	2	100 bbl/day Saackle burners, complete
	1	Dispersant spray system

Source: Union Oil Company of California, 1985.

1/ This is not a complete inventory.

Table C-4
Table of Spill-Response Equipment on the Icebreaker Robert Lemeur
During Drilling in the Beaufort Sea Planning Area, Summer 1985

All equipment except boom and Canmar equipment
stored in 36- by 9- by 8-foot spill-response van on vessel.
See end of table for Canmar equipment.

Category	Quantity	Description	Operational Considerations
Vessels	2	26-ft. Munson aluminum work boats, each with two 140-hp motors	Operating speed more than 32 knots; fully protected and heated wheelhouse.
Containment	3	Kepner Reel Pak (500-ft./Pak)	Rapid deployment (less than 5 minutes); effective in 1- to 2-ft. wind-waves; 1,500-ft. of boom capable of holding several 1,000 bbl/in. of oil depth.
	1,000 ft.	Shell fire-resistant boom	Tested resistance to burn for fire-resistant boom: minimum 6 hr.
Oil Recovery	1	SLURP weir skimmer (57 lb.) w/accessories	No moving parts; approximately 30 gpm recovery potential; effective in calm water only.
	1	CSI rope mop skimmer w/200-ft. mop, swivel base, and 3 tail pulleys	Effective on water, in broken ice, and on/under solid ice; 10 to 20 gpm recovery potential.
	20	3M sorbent rolls (38 lb./roll)	Sorbents: Sorptive capacity typically 60 to 80 gal. per roll.
Storage	4	10,000 storage containers	Arctic grade, cold-crack temperature (-65°F).
Transfer	4	Pumps (trash, diaphragm, centrifugal)	Typically 80 gpm to 300 gpm pump rates.
	1,200 ft.	2 in. and 3 in.	Arctic grade, cold-crack temperature (-65°F).
		CANMAR EQUPMENT	
Containment	700 ft.	36-in. offshore Navy boom	
Oil Recovery	30 bags 30 bales	Floor Dry sorbent pads	
Transfer	1 200 ft.	Spate or Komline Sanderson pump 2-in. or 3-in. arctic hose	

Source: Union Oil Company of California, 1985; MMS, Alaska OCS Region.

Table C-5
Estimated Response Times for Mobilizing and
Transporting Equipment to Deadhorse by Air Cargo Transport

Equipment Owner	Storage Location	Estimated Mobilization Time 1/ (Hours) (Min.)	(Max.)	Transportation Time to Deadhorse 2/ (Hours)	Total Response Time to Deadhorse 3/ (Hours) (Min.)	(Max.)
Alaska Clean Seas	Anchorage	2	5	1.9	3.9	6.9
	Dutch Harbor	2	5	3.3	5.3	8.3
Alyeska Pipeline	Valdez	2	5	2.0	4.0	7.0
Cook Inlet Response Organization	Kenai	2	5	2.0	4.0	7.0
U.S. Coast Guard	Kodiak	2	5	2.6	4.6	7.6
	Anchorage	2	5	1.9	3.9	6.9
Crowley Environmental Services	Anchorage	2	5	1.9	3.9	6.9
	Prudhoe Bay	1	4	0	1.0	4.0
Clean Sound	Seattle	2	5	6.1	8.1	11.1
Clean Seas	Santa Barbara	2	5	7.1	9.1	12.1
Clean Coastal Waters	Long Beach	2	5	7.9	9.9	12.9
U.S. Navy	Stockton	2	5	7.1	9.1	12.1

Source: Alaska Clean Seas, 1984.

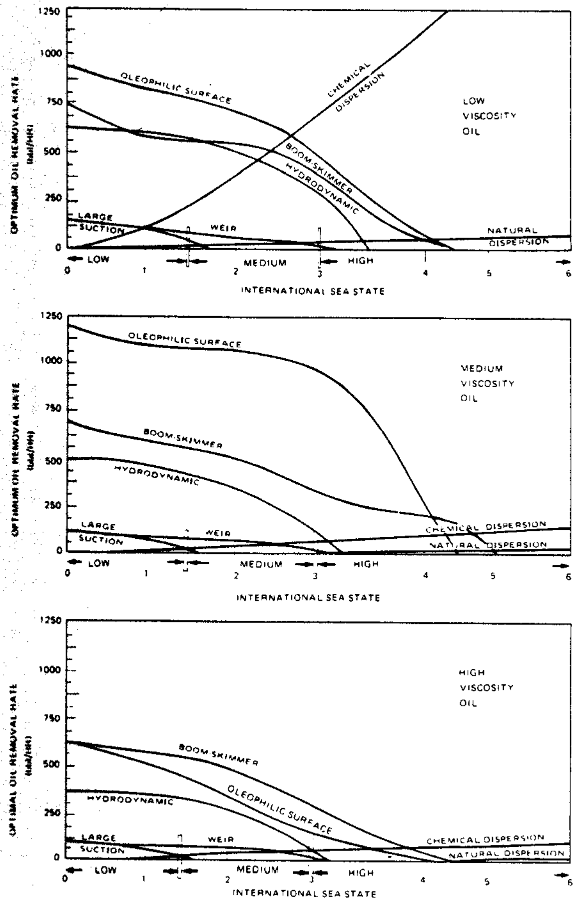
1/ Estimated mobilization times were supplied by equipment owners and are overall ranges that are nonspecific to the type or quantity of equipment required.
2/ Estimated transportation times are based on air cargo transport (e.g., Lockheed Hercules) flight characteristics (300-knot flight speed).
3/ Total response times are the sum of estimated mobilization time and travel times by air cargo transport (e.g., Lockheed Hercules). They do not include the amount of time required to load the equipment or variations in travel time arising from adverse climatic factors that might be encountered enroute.

Table C-6
Estimated Response Times for Mobilizing and
Transporting Equipment to the ABSORB Area by Surface Vessel 1/

Equipment Owner	Storage Location	Estimated Mobilization Time 2/ (Hrs.) (Min.)	(Max.)	Estimated Travel Time to Prudhoe Bay (10 Knots) 3/ (Days)	(Hrs.)	Total Response Time 4/ Minimum (Days)	Minimum (Hrs.)	Maximum (Days)	Maximum (Hrs.)
Alaska Clean Seas	Dutch Harbor	2	5	6	0	6	2	6	5
	Anchorage	2	5	8	19	8	21	9	0
Alyeska	Valdez	2	5	9	0	9	2	9	5
Cook Inlet Response Organization	Kenai	2	5	8	12	8	14	8	17
U.S. Coast Guard	Kodiak	2	5	8	1	8	38	8	6
	Anchorage	2	5	8	19	8	21	9	0
Crowley Environmental Services	Anchorage	2	5	8	19	8	21	9	0

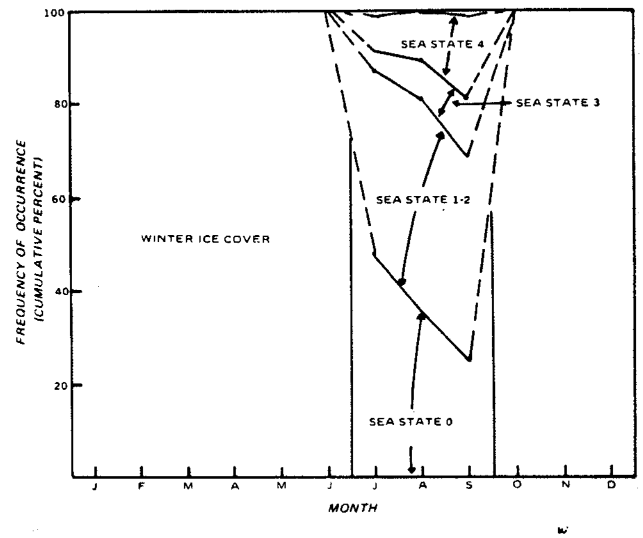
Source: Alaska Clean Seas, 1984.

1/ Surface-vessel transportation is available only during the open-water season around Pt. Barrow. This season is of limited duration--typically 6 to 8 weeks per year.
2/ Estimated mobilization times were supplied by the equipment owners and are overall ranges that are nonspecific to the type or quantity of equipment required; vessel availability is assumed.
3/ Travel times to site are from ports near the storage sites to Prudhoe Bay. These estimates do not include the amount of time required to unload the equipment at the site or variations in travel time arising from adverse climatic factors.
4/ Total response times indicated are the sum of estimated mobilization times and travel times to the spill site.



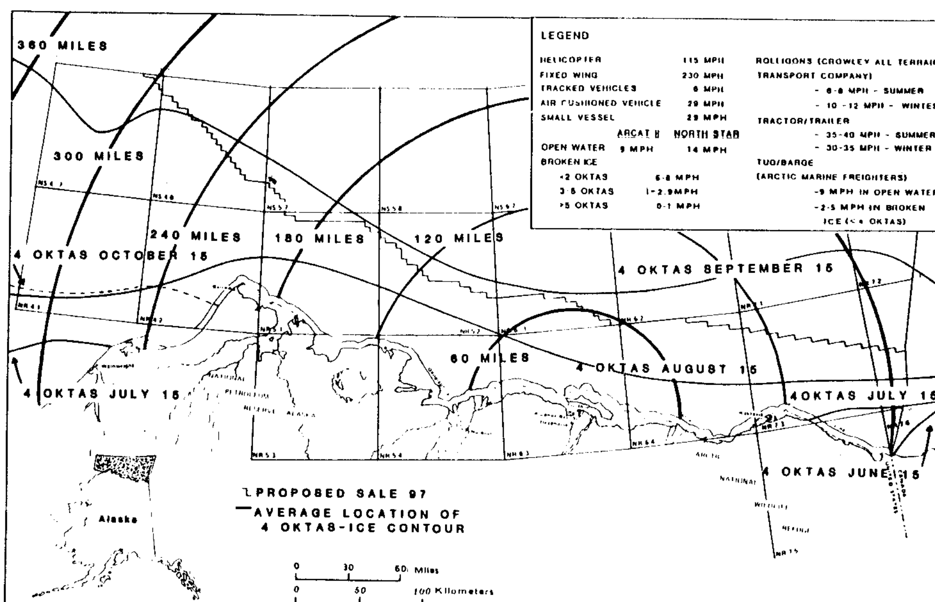
Source: S.L. Ross Environmental Research Limited, 1983a.

FIGURE C-2. OPTIMUM OIL RECOVERY RATE FOR GENERIC CLASSIFICATIONS OF SKIMMERS VERSUS NATURAL AND CHEMICAL DISPERSION



Source: Derived from wave data for Marine Area A in Brower et al., 1977.

FIGURE C-3. CUMULATIVE FREQUENCY OF OCCURRENCE OF DIFFERENT INTERNATIONAL SEA STATES IN OPEN WATER IN THE BEAUFORT SEA PLANNING AREA BY MONTH



Source: Alaska Clean Seas, 1984; Labelle et al., 1983; and Alaska OCS Region

FIGURE C-1. DISTANCES FROM PRUDHOE BAY, RESPONSE SPEEDS FOR VARIOUS CRAFT AND VEHICLES, AND LOCATION OF THE 4-OKTA–ICE CONTOUR

D

APPENDIX D

MMS ALASKA OCS REGION STUDIES PROGRAM

Environmental Studies Program

In response to the Federal Government's decision to lease offshore areas for oil and gas exploration in Alaska, an Environmental Studies Program (ESP) was initiated in 1974 to gather, analyze, and synthesize pertinent information for assessing pre- and postsale effects on the marine environment. The protection of the marine environment is mandated by several legislative acts: the OCS Lands Act of 1953, amended in 1978, gave the Bureau of Land Management (BLM) and United States Geological Survey (USGS) responsibility for leasing submerged Federal lands. (The offices under the BLM and USGS responsible for offshore leasing were reorganized as the Minerals Management Service (MMS) in 1982.) One of the goals of the Act is to provide for protection of the environment concomitant with mineral-resource development. The National Environmental Policy Act of 1969 (NEPA) requires all Federal Agencies to use a systematic, interdisciplinary approach that will ensure the integrated use of natural and social sciences in any planning and decisionmaking that may have an effect on the environment. Additional Federal laws--such as the Coastal Zone Management Act; the Federal Water Pollution Control Act Amendments; the Marine Mammal Protection Act; the Endangered Species Act; and the Marine Protection, Research, and Sanctuaries Act--have imposed additional environmental requirements on the OCS leasing process.

As the managing agency for the OCS leasing program in Alaska, the MMS Alaska OCS Region has conducted environmental and socioeconomic studies to obtain information needed for sound leasing decisions, as well as to monitor human, marine, and coastal environments.

A portion of the Alaska ESP is managed for the MMS through an interagency agreement with the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. The NOAA manages this program through the Outer Continental Shelf Environmental Assessment Program (OCSEAP) office in Anchorage, Alaska. Other environmental and all social and economic studies are administered and contracted directly from the MMS Alaska OCS Region Office in Anchorage.

The principal goals of the Alaska ESP are to:

1. Describe and predict physical and chemical processes that influence the weathering and transport of spilled oil and other oil- and gas-related pollutants;

2. Characterize regional biota, habitats, and ecosystems and analyze ecosystem functioning to develop an understanding of the possible effects of oil- and gas-development activities;

3. Describe geologic, meteorologic, and ice hazards that may affect activities associated with oil and gas development;

4. Develop and implement targeted environmental monitoring programs to assess the effects of exploration and development activities on marine resources; and

5. Determine and assess potential social and economic effects from oil- and gas-development activities.

Not all informational needs are, or can be, obtained prior to a lease sale. If economic hydrocarbon resources are discovered, oil and gas production is likely to begin 10 to 15 years after the sale. This period allows continuing studies to address environmental concerns. The ESP monitors the marine environment to discern if any effects from OCS activities have occurred. In anticipation of shifts in information needs relative to development-stage decisions, the ESP has increased studies to meet postlease and monitoring-information requirements. Detailed rationale for the Alaska OCS Region's program can be found yearly in the Alaska Regional Studies Plan (RSP), which is prepared annually.

An integral part of the ESP is to ensure that the information obtained is presented in a timely fashion and in a usable form for the interested public, personnel associated with the leasing process, and the governmental decisionmakers. Throughout the leasing process, there are scheduled events and documents in which information is presented. Annual and final reports are required for each phase of a study. A synthesis of available data is scheduled for each lease sale prior to writing the draft Environmental Impact Statement (DEIS). The synthesis provides the most current environmental information and preliminary analysis of data available to the authors of the DEIS, the public, and the decisionmakers.

Beaufort Sea Environmental Studies List

Identification, Documentation and Delineation of Coastal Migratory Bird Habitats in Alaska, Alaska Department of Fish and Game, NOAA/OCSEAP Research Unit No. 3/4, September 1980.

Distribution, Abundance, Community Structure and Trophic Relationships of the Nearshore Benthos, University of Alaska, NOAA/OCSEAP Research Unit No. 5, December 1981.

Distribution, Composition, and Variability of Western Beaufort and Northern Chukchi Sea Benthos, Oregon State University, NOAA/OCSEAP Research Unit No. 6, June 1984.

Summarization of Existing Literature and Unpublished Data on Distribution, Abundance, and Life Histories of Benthic Organisms of the Beaufort Sea, Oregon State University, NOAA/OCSEAP Research Unit No. 7, January 1977.

Assessment of Potential Interactions of Micro-organisms and Pollutants Resulting from Petroleum Development on the OCS in the Beaufort Sea, University of Louisville, NOAA/OCSEAP Research Unit No. 29, December 1982.

Analysis of Marine Mammal Remote Sensing Data, Johns Hopkins University, NOAA/OCSEAP Research Unit No. 34, April 1977.

Trace Hydrocarbon Analysis in Previously Studied Matrices and Methods Development for a) Trace HC Analysis in Sea Ice and at the Sea Ice-Water Interface and b) Analysis of Individual High Molecular Weight Aromatic HC, National Bureau of Standards, NOAA/OCSEAP Research Unit No. 43, January 1980.

Environmental Assessment of Alaskan Waters - Trace Element Methodology - Inorganic Elements, National Bureau of Standards, NOAA/OCSEAP Research Unit No. 47, May 1977.

Coastal Morphology, Sedimentation, and Oilspill Vulnerability, RPI, Inc., NOAA/OCSEAP Research Unit No. 59, April 1980.

Migration, Distribution, and Abundance of Bowhead and Beluga Whales in the Arctic Oceans, National Marine Fisheries Service, NOAA/OCSEAP Research Unit No. 69/70, October 1981.

Lethal and Sublethal Effects On Selected Alaskan Marine Species After Acute and Long-Term Exposure to Oil, National Marine Fisheries Service, NOAA/OCSEAP Research Unit No. 72, April 1983.

Sublethal Effects of Petroleum as Reflected By Morphological, Chemical, Physiological, Pathological and Behavioral Indices, National Marine Fisheries Service, NOAA/OCSEAP Research Unit No. 73, June 1982.

Identification of Major Processes in Biotransformations of Petroleum HC and Trace Metals, National Marine Fisheries Service, NOAA/OCSEAP Research Unit No. 74, June 1982.

Assessment of Available Literature: Oil Pollution Effects on Biota in Arctic and Subarctic Waters, National Marine Fisheries Service, NOAA/OCSEAP Research Unit No. 75, November 1976.

Beaufort Shelf Surface Currents, United States Coast Guard, NOAA/OCSEAP Research Unit No. 81, April 1977.

Interaction of Oil With Sea Ice in the Beaufort Sea, University of Washington, NOAA/OCSEAP Research Unit No. 87, May 1982.

Dynamics of Nearshore Ice, U.S. Army-CRREL, NOAA/OCSEAP Research Unit No. 88, Ongoing Study.

Current Measurements in Possible Dispersal Regions of the Beaufort Sea, University of Washington, NOAA/OCSEAP Research Unit No. 91/151, January 1981.

Dynamics of Nearshore Ice, Flow Research Co., NOAA/OCSEAP Research Unit No. 98, March 1979.

Delineation and Engineering Characteristics of Permafrost Beneath the Arctic Seas, U.S. Army-CRREL, NOAA/OCSEAP Research Unit No. 105, May 1982.

Seasonality and Variability of Streamflow Important to Alaskan Nearshore Coastal Areas, University of Alaska, NOAA/OCSEAP Research Unit No. 111, March 1977.

Natural Distribution of Trace Heavy Metals and Environmental Background in Three Alaskan Shelf Areas, University of Alaska, NOAA/OCSEAP Research Unit No. 162, May 1979.

Shorebird Dependence on Arctic Littoral Habitats, University of California, NOAA/OCSEAP Research Unit No. 172, September 1982.

Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea, Oregon State University, NOAA/OCSEAP Research Unit No. 190, December 1980.

Morbidity and Mortality of Marine Mammals, University of Alaska, NOAA/OCSEAP Research Unit No. 194, December 1980.

Distribution, Abundance, and Feeding Ecology of Birds Associated with Sea Ice, College of the Atlantic, NOAA/OCSEAP Research Unit No. 196, January 1983.

Offshore Permafrost Studies, U.S. Geological Survey, NOAA/OCSEAP Research Unit No. 204/473, Ongoing Study.

Geologic Environment of the Chukchi and Beaufort Sea Shelf and Coastal Regions, U.S. Geological Survey, NOAA/OCSEAP Research Unit No. 205, Ongoing Study.

Avifaunal Utilization of the Offshore Islands Near Prudhoe Bay Alaska, University of Alaska, NOAA/OCSEAP Research Unit No. 215, March 1977.

The Natural History and Ecology of the Bearded Seal and the Ringed Seal, Alaska Department of Fish and Game, NOAA/OCSEAP Research Unit No. 230, May 1979.

Trophic Relationships Among Ice Inhabiting Phocid Seals and Functionally Related Marine Mammals in the Arctic, Alaska Department of Fish and Game, NOAA/OCSEAP Research Unit No. 232, February 1982.

Beaufort Sea Estuarine Fishery Study, Alaska Department of Fish and Game, NOAA/OCSEAP Research Unit No. 233, October 1977.

Study of Climatic Effects on Fast Ice Extent and its Seasonal Decay Along the Beaufort Sea/Chukchi Sea Coasts, University of Colorado, NOAA/OCSEAP Research Unit No. 244, March 1979.

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Mechanics of Origin of Pressure, Shear Ridges, and Hummock Fields in landfast Ice, University of Alaska, NOAA/OCSEAP Research Unit No. 250, Ongoing Study.

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Arctic Offshore Permafrost Studies, Michigan Technical University/University of Alaska, NOAA/OCSEAP Research Unit No. 271/610, September 1982.

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Review and Analysis of Literature and Unpublished Data on Marine Birds, U.S. Fish and Wildlife Service, NOAA/OCSEAP Research Unit No. 339, December 1980.

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Characterization of the Nearshore Hydrodynamics of Arctic Barrier Island-Lagoon System, University of Alaska, NOAA/OCSEAP Research Unit No. 526, March 1981.

Sediment Characterization, Stability, and Origin of Barrier Island-Lagoon Complex, North Arctic, Alaska, University of Alaska, NOAA/OCSEAP Research Unit No. 529, August 1982.

Geology and Geomorphology of the Barrier Island-Lagoon System Along the Beaufort Sea Coastal Plain, University of Alaska, NOAA/OCSEAP Research Unit No. 530, July 1981.

Oceanographic Processes in a Beaufort Sea Barrier Island-Lagoon System and its Surroundings; Numerical Modelling and Current Measurements, Kinnetic Laboratories, Inc., NOAA/OCSEAP Research Unit No. 531, June 1982.

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Transport and Behavior of Oil Spilled In and Under Sea Ice (Task I), Flow Research Co., NOAA/OCSEAP Research Unit No. 567, January 1983.

Transport and Behavior of Oil Spilled In and Under Sea Ice (Task II and III), ARCTEC Incorporated, NOAA/OCSEAP Research Unit No. 568, September 1980.

Baffin Island Oil Spill Project, Environmental Protection Service (Canada), NOAA/OCSEAP Research Unit No. 606, February 1984.

Arctic Offshore Permafrost Studies, Michigan Technical University, NOAA/OCSEAP Research Unit No. 610, September 1982.

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APPENDIX E

SUMMARY OF MINIMUM AND MAXIMUM EFFECTS

E

I. MINIMUM CASE

A. Resource Estimate

The minimum case is associated the low-case resource estimate of 110 MMbbls of oil (Appendix G, Table G-1).

B. Activities Associated with Exploration, Development and Production, and Transportation

The types of technologies and the infrastructure used to explore, develop and produce, and transport the oil associated with the minimum case would generally be the same as described for the proposal using the mean-case resource estimate of 650 MMbbls: Sections II.A.2 through II.A.4. However, the level of activities would be less and the size and scope of the support facilities would be smaller because of the lower resource estimate.

The exploration period is expected to begin in 1989 and end in 1990. Two delineation wells are expected to be drilling during this period. Prior to drilling, the lessee/operator is required to conduct surveys of sufficient detail to define shallow hazards or the absence thereof; these surveys should incorporate seismic profiling. The projected level of seismic activity is based upon the nature and extent of the surveys that may be required (Notice to Lessees [NTL] 83-5, Minimum Requirements, Shallow Hazards Survey) and the predicted number of wells drilled. Seismic surveys of the delineation-well sites would be conducted in the ice-free seasons during the years of the exploration phase. The total seismic activity is estimated to take 4 days and cover 128 seismic-line kilometers in 2 areas that total 46 square kilometers. (The assumptions used to determine the amount of seismic activity are shown in Appendix G, Table G-11.) Approximately 970 tons of dry solids will be used in the drilling muds for each delineation well, and each well is expected to produce approximately 1,800 tons (dry weight) of drill cuttings. Personnel and routine supplies and material are expected to be transported to the drilling units from the support base by helicopters. The total number of helicopter trips is estimated to be about 180. This estimate is based on the assumptions that, for each well, there will be 1 flight for each day of drilling and the time required to drill and test a well is about 90 days.

During development and production, 1 production platform would be installed in 1995 and 7 production and service wells would be drilled between 1995 and 1996. Shallow-hazards seismic surveys would also be conducted before the platform is installed. Because the size of the individual prospects is unknown, it is assumed that a block-wide survey will be conducted (Appendix G, Table G-11). The seismic activity associated with the platform installation is estimated to take 7 days and cover 304 line kilometers in an area of about 92 square kilometers. Drilling of the production and service wells would result in the net average disposal of 77 tons (dry weight) of drilling mud for each well. (Mud used in drilling the production and service wells is assumed to be recycled through each subsequent well on the platform.) Also, each well is expected to produce approximately 1,850 tons (dry weight) of drill cuttings. The number of helicopter flights to be flown in support of the drilling of the production and service wells is estimated to be about 315. This estimate is based on the assumptions that there will be 1 flight for each day of drilling and the time required to drill and complete a well is about 45

days. Oil production is expected to begin in 1996. Peak production of 9 MMbbls of oil would be between 1997 and 2002. Production would begin to decline in 2003 and end in 2014.

Because of the small resource estimate, a separate pipeline connecting the platform to the shore would not be installed. Instead, it is assumed that the production platform associated with the low-case resource estimate would be installed near another platform in a previous lease-sale area and share the pipeline from this platform to the shore.

The most likely number of oil spills of 1,000 barrels or greater associated with the discovery of 110 MMbbls of oil is 1.

C. Environmental Consequences

The following discussions summarize the possible minimum environmental effects for issues that could derive from the low case, based on the level of activities and schedule of events that have been predicted for the low-case resource estimate.

1. Effects on Lower-Trophic-Level Organisms: The significant reduction in oil resources assumed in the minimum case probably would result in decreased probability of oil spills, fewer platforms and wells (hence fewer sources and a lesser quantity of drilling discharges), and reduced dredging and construction activity. Therefore, a reduced number and extent of site-specific effects are expected compared to the proposal. Fewer numbers of organisms and a smaller extent of habitat are expected to be affected. Effects on marine plants and invertebrates from the minimum case are most likely to be MINOR.

2. Effects on Fishes: The significant reduction in oil resources assumed in the minimum case probably would result in decreased probability of oil spills, fewer platforms and wells (hence fewer sources and a lesser quantity of drilling discharges), and reduced dredging and construction activity. Therefore, a reduced number and extent of site-specific effects are expected compared to the proposal. Fewer numbers of organisms and a smaller extent of habitat are expected to be affected. The occurrence of oil spills, seismic surveys, drilling discharges, and construction activities probably would produce a MINOR effect on fishes. Therefore, effects on fishes under the minimum case are most likely to be MINOR.

3. Effects on Marine and Coastal Birds: The significant reduction in oil resources assumed in the minimum case probably would result in less chance of oil spills occurring and affecting marine and coastal birds and their habitats. Fewer numbers of birds might be affected by oil pollution and disturbance than described in the mean case of the proposal. Substantial long-term effects on local or regional populations would be very unlikely. Effects on marine and coastal birds under the minimum case probably would be MINOR instead of MODERATE under the mean case.

4. Effects on Pinnipeds, Polar Bears, and Beluga Whales: Overall effects on marine mammals from oil spills and disturbance associated with development and transport of extracted oil probably would be less than described for the proposal, since spill rates and volume of oil transported

would presumably be reduced. Short-term localized effects could occur, however, in the event of an oil spill. Industrial activity could still potentially disturb population segments of marine mammals regardless of the lower level of petroleum-resource estimates. Effects on marine mammals probably would be MINOR under the minimum case, as they are in the mean case.

5. Effects on Endangered and Threatened Species: Overall effects on endangered and threatened species from direct and indirect effects of oil spills or disturbances associated with development and the transport of extracted oil would be less than described for the proposal. Because only one exploration unit and one production platform are assumed to be used in the minimum case, spill rates and the volume of oil transported would be reduced. Short-term localized effects could occur in the event of an oil spill. Industrial activity during the bowhead migration and gray whale summer-feeding periods in the sale area could still pose spill risks and/or potentially disturb portions of endangered species populations, regardless of the absolute level of petroleum-resource estimates.

Under the minimum case, as for the proposal, the level of effect on the bowhead whale probably would be MINOR, and the level of effect on the gray whale and arctic peregrine falcon probably would be NEGLIGIBLE.

6. Effects on Caribou: Overall effects on caribou due to disturbance and habitat alterations probably would be somewhat less than described for the proposal, since levels of onshore development would presumably be less. Industrial activity is likely to disturb some caribou regardless of the absolute level of petroleum-resource estimates. Effects of development on caribou probably would not exceed a MINOR level.

7. Effects on Population: Overall effects would be NEGLIGIBLE. The resident population of the North Slope Borough could not be expected to change by any significant amount. Development of the minimum level of resources would contribute to only a few jobs for Native residents and would not enhance the Borough property-tax base. Statewide effects of this minimum case would be significantly less than the effects of the proposal. This would be especially true when comparing the construction phases of the proposal and the minimum case because, in the minimum case, construction is limited to the expansion of an existing production island (see Sec. II.A).

8. Effects on North Slope Sociocultural Sytems: The minimum-case estimate of 110 MMbbls probably would lower the MINOR positive benefits to NSB general revenues and small businesses to NEGLIGIBLE levels. However, even one oil spill of 1,000 barrels or greater has the potential for MODERATE consequences for North Slope political institutions. Other consequences to sociocultural institutions from the minimum-case estimate would likely be NEGLIGIBLE.

9. Effects on Subsistence-Harvest Patterns: Effects associated with a low find would be much less intense than those expected under the mean-find scenario. On the North Slope, decreased oil production would reduce the oil-spill risk to subsistence resources and especially lower the risk to marine mammals. Villagers' concern over local key-subsistence resources and

areawide worries about the bowhead whale would remain significant unless strongly contradicted by experience. Effects of onshore facilities would be mitigated locally if low finds led to construction delays or cancellations.

10. Effects on the Economy of the North Slope Borough: For the minimum case, the employment effect in the NSB is projected to be about 50 percent as great as that for the mean case. The overall cumulative effects for the minimum case in the NSB would be MINOR. The economy effects of this minimum case would be classified as MINOR and beneficial in the North Slope region. (The reduction in effects, as compared to the mean case, is not sufficient to place the effects of the minimum case in the category of NEGLIGIBLE.) The economic effects of the minimum case would be classified as MINOR and beneficial in the North Slope region.

II. MAXIMUM CASE

A. Resource Estimate

The maximum case is assocated with the high-case resource estimate of 1,660 MMbbls of oil (Appendix G, Table G-1).

B. Activities Associated with Exploration, Development and Production, and Transportation

The types of technologies and infrastructure used to explore, develop and produce, and transport oil associated with the maximum case would generally be the same as described for the proposal using the mean-case resource estimate: Sections II.A.2 through II.A.4. However, the level of activities would be greater and the size and scope of the support facilities would be larger than for the proposal because of higher resource estimates.

The exploration period is expected to begin in 1988 and end in 1993. During this period, 23 exploration wells and 15 delineation wells are expected to be drilled. Prior to drilling, the lessee/operator is required to conduct surveys of sufficient detail to define shallow hazards or the absence thereof; these surveys should incorporate seismic profiling. The projected level of seismic activity is based upon the nature and extent of the surveys that may be required (Notice to Lessees [NTL] 83-5, Minimum Requirements, Shallow Hazards Survey) and the predicted number of wells drilled. Seismic surveys of the exploration-/delineation-well sites would be conducted in the ice-free seasons during the years of the exploration phase. The total seismic activity in the Sale 97 area is estimated to take 76 days and cover 2,440 seismic-line kilometers in 38 areas that total 874 square kilometers. (The assumptions used to determine the amount of seismic activity are shown in Appendix G, Table G-11.) Approximately 970 tons of dry solids will be used in the drilling muds for each exploration and delineation well drilled, and each well is expected to produce approximately 1,800 tons (dry weight) of drill cuttings.

Personnel and routine supplies and materials are expected to be transported to the drilling units from the support base by helicopters. The number of helicopter trips flown in support of exploration- and delineation-well drilling in the Sale 97 area is estimated to range from about 180 in the year when 2 wells are expected to be drilled to 630 in the years from 1989 through 1991, when 7 wells could be drilled in each year. These estimates are based on the assumptions that, for each well, there will be 1 flight for each day of drilling and, as noted previously, the time required to drill and test a well is about 90 days. During the period from 1988 to 1994, the total number of helicopter flights supporting drilling operations is estimated to be 3,420.

The number of required support vessels for each drilling unit will depend, at least in part, on the type and characteristics of the unit and the sea-ice conditions. If there are drilling operations during the open-water season, MMS requires the operator to maintain an emergency standby vessel within the immediate vicinity of the drilling unit. (Immediate vicinity is defined as being within 5 miles or a 20-minute steaming distance of the unit, whichever is less.) The primary reason for this requirement is to ensure evacuation of personnel in the event of an emergency, but the standby vessel also could assist in the deployment of the oil boom in the event of an oil spill. Depending on ice conditions, two or more icebreaking vessels may be required to perform ice-management tasks for the floating units.

During development and production, 1 production platform would be installed in 1994, 5 platforms in 1995, and 101 production and service wells would be drilled between 1994 and 1997. Shallow-hazards seismic surveys will also be required before the platforms are installed. Because the size of the individual prospects is unknown, it is assumed that block-wide surveys will be conducted. The seismic activity associated with the platform installation is estimated to take 42 days and cover about 2,129 line kilometers in 7 areas that total 644 square kilometers. Drilling of the production and service wells would result in the net average disposal of 77 tons (dry weight) of drilling mud for each well. (Mud used in drilling the production and service wells is assumed to be recycled through each subsequent well on a particular platform.) Also, each well is expected to produce approximately 1,850 tons (dry weight) of drill cuttings. The number of helicopter flights to be flown in support of the drilling of the production and service wells is estimated to be about 4,545. This estimate is based on the assumption that there will be one flight for each well for each day of drilling and that the time required to drill and complete a well is about 45 days.

Approximately 480 kilometers of pipeline (one-half onshore and the other half offshore) would be laid to transport the oil from the production platforms to TAP. Pipelaying would occur between 1993 and 1995.

Oil production is expected to begin in 1997 and to peak at 139 MMbbls of oil between 1998 and 2003. Production would begin to decline in 2004 and end in 2015.

The most likely number of oil spills of 1,000 barrels or greater associated with 1,660 MMbbls is 32.

C. Environmental Consequences

The following discussions summarize the possible maximum environmental effects for issues that could derive from the high case, based an the level of activities and schedule of events that have been predicted for the high-case resource estimate.

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1. Effects on Lower-Trophic-Level Organisms: The two- to threefold increase in oil resources assumed in the maximum case probably would result in an increased probability of oil spills and more platforms and wells (hence more sources and a greater quantity of drilling discharges), and increased dredging and construction activity. Therefore, an increased number and extent of site-specific effects are expected compared to the proposal. Even though the number and extent of site-specific effects on marine plants and invertebrates could be greater than those projected for the proposal, regional populations are unlikely to be affected; and effects are most likely to be MINOR. However, MODERATE effects are possible for the Boulder Patch community if it were contacted by oil.

2. Effects on Fishes: The two- to threefold increase in oil resources assumed in the maximum case probably would result in an increased probability of oil spills, more platforms and wells (hence more sources and a greater quantity of drilling discharges), and increased dredging and construction activity. Therefore, an increased number and extent of site-specific effects are expected compared to the proposal. Greater numbers of organisms and a greater extent of habitat are expected to be affected. Since no long causeways are projected to be built under the high-case resource estimate, negative effects are most likely to result from oil spills. Effects under the maximum case are not expected to exceed MINOR, although MODERATE effects are possible for capelin and some anadromous fishes if spawning individuals or a year-class of young were killed.

3. Effects on Marine and Coastal Birds: Nearly a threefold increase in oil resources assumed in the maximum case could significantly increase the chances of oil spills occurring and adversely disturbing marine and coastal bird populations and their habitats. A greater number of birds may be directly killed by oil pollution. In the maximum case, a substantial reduction in local bird populations could occur with perhaps loss of several thousand birds from more than one spill. Effects could range from MODERATE to MAJOR in the maximum case. However, natural recruitment of birds from unaffected areas and the wide distribution of alternate habitats indicate that effects probably would not exceed MODERATE. Regional populations also could be reduced.

4. Effects on Pinnipeds, Polar Bears, and Beluga Whales: Overall effects on these marine mammals due to direct and indirect effects of oil spills or disturbance associated with development and transport of extracted oil would be greater than those described for the proposal. Since the maximum case assumes about three times the level of petroleum resources as estimated for the mean case, a substantial increase in spill-contact probabilities for major whale and marine-mammal migration/feeding areas would be expected. Increased noise and disturbance associated with the higher levels of development that would be expected with the maximum case could result in more localized changes in distribution. However, considering the widespread distribution of marine mammals in the planning area and natural recruitment from unaffected areas, effects on marine mammals probably would not exceed MODERATE.

5. Effects on Endangered and Threatened Species: Overall effects on endangered and threatened species from direct and indirect effects of oil spills or disturbance associated with the development and transport of

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extracted oil would be greater than those described for the mean case. Because the maximum case assumes over twice the level of petroleum resources as estimated for the mean case, an increase in spill-contact probabilities would be expected. Increased noise and disturbance associated with higher levels of development than would be expected with the maximum case (up to six production platforms) could result in more localized changes in distribution and/or density of potentially sensitive endangered species. Effects on bowhead whales would be MODERATE, as compared with MINOR for the proposal. Effects on gray whales would be MINOR and effects on arctic peregrine falcons would be NEGLIGIBLE, the same as for the proposal.

6. Effects on Caribou: Overall effects on caribou due to disturbance and habitat alterations probably would increase over the effects described for the proposal. Levels of onshore development are likely to increase in the maximum case. Greater displacement of caribou from summer habitats could occur. Effects on caribou could be MODERATE.

7. Effects on Population: The effects of this development case on the North Slope resident population would be MINOR. In this case, we assume that the value of onshore support and pipelines will be significantly greater than the proposal. This means that, while direct employment of Native residents on the North Slope would remain relatively small, the contribution of this development to the revenues of the North Slope Borough would sustain NSB operating employment. As discussed in Section IV.B.7, any employment opportunities would reduce Native out-migration; thus, the level of the resident population would be sustained at a higher level through 2010. Statewide population effects would remain NEGLIGIBLE. This is judged on the basis of the large percentage of nonresident workers historically associated with the oil industry and the expectation that most State residents would choose to live in the urban southcentral region.

8. Effects on North Slope Sociocultural Systems: With two exceptions, the maximum-case estimate probably will not alter the effects projected for the proposal. However, the possibility of 32 oil spills of 1,000 barrels or greater would place severe stresses on North Slope political institutions. Despite these stresses, the consequences are still judged to be MODERATE, as the long-term disruption of political institutions is not likely to lead to their displacement. The number of oil spills also has the potential of raising the MINOR consequences to kinship and sharing and social pathologies to MODERATE levels.

9. Effects on Subsistence-Harvest Patterns: Effects associated with a high find would be more intense than those expected under the mean case. On the North Slope, higher production levels would raise the risk of oil spills to marine mammals, fishes, and birds--all key subsistence resources. If such increased risks were realized, local concerns over them would intensify.

10. Effects on the Economy of the North Slope Borough: Employment effects of the maximum case in the North Slope region could be about 50-percent greater than the effects of the mean case discussed in Section IV.B.10. The economic effects of the maximum case would be classified the same as those of the proposal--MODERATE and beneficial in the North Slope region. The cumulative effects of the maximum case also would be the same as those of the proposal--MODERATE and beneficial in the North Slope region.

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APPENDIX F

OIL-SPILL-RISK ANALYSIS

F

List of Tables

Table F-28	Combined Probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Barrow Deferral Alternative versus Chukchi Deferral Alternative versus Kaktovik Deferral Alternative. Probabilities are for spills 100,000 barrels or greater. Results are based on open-water trajectories only; for contacts within 3, 10, and 30 days of summer spills or melt out of overwintering spills.
Table F-29	Combined Probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, proposed lease offering versus Barrow Deferral Alternative versus the cumulative case (proposal plus existing, including Canadian oil). Probabilities are for spills 100,000 barrels and greater. Results are based on open-water trajectories only; for contacts within 3, 10, and 30 days of summer spills or melt out of overwintering spills.
Table F-30	Combined Probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Barrow Deferral Alternative versus Chukchi Deferral Alternative versus Kaktovik Deferral Alternative. Probabilities are for spills 100,000 barrels or greater. Results are based on open-water trajectories only; for contacts within 3, 10, and 30 days of summer spills or melt out of overwintering spills.

Table F-2

Monte Carlo error as a function of the number of trials and the estimated propability

NUMBER OF TRIALS

PROB	10	20	40	50	100	200	500	1000	2000
0.02	0.07	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01
0.04	0.10	0.07	0.05	0.05	0.03	0.02	0.01	0.01	0.01
0.06	0.12	0.09	0.06	0.06	0.04	0.03	0.02	0.01	0.01
0.08	0.14	0.10	0.07	0.06	0.04	0.03	0.02	0.01	0.01
0.10	0.16	0.11	0.08	0.07	0.05	0.04	0.02	0.02	0.01
0.12	0.17	0.12	0.08	0.08	0.05	0.04	0.02	0.02	0.01
0.14	0.18	0.13	0.09	0.08	0.06	0.04	0.03	0.02	0.01
0.16	0.19	0.14	0.10	0.09	0.06	0.04	0.03	0.02	0.01
0.18	0.20	0.14	0.10	0.09	0.06	0.04	0.03	0.02	0.01
0.20	0.21	0.15	0.10	0.09	0.07	0.05	0.03	0.02	0.01
0.22	0.22	0.16	0.11	0.10	0.07	0.05	0.03	0.02	0.02
0.24	0.22	0.16	0.11	0.10	0.07	0.05	0.03	0.02	0.02
0.26	0.23	0.16	0.11	0.10	0.07	0.05	0.03	0.02	0.02
0.28	0.23	0.17	0.12	0.10	0.07	0.05	0.03	0.02	0.02
0.30	0.24	0.17	0.12	0.11	0.08	0.05	0.03	0.02	0.02
0.32	0.24	0.17	0.12	0.11	0.08	0.05	0.03	0.02	0.02
0.34	0.25	0.17	0.12	0.11	0.08	0.06	0.03	0.02	0.02
0.36	0.25	0.18	0.13	0.11	0.08	0.06	0.04	0.03	0.02
0.38	0.25	0.18	0.13	0.11	0.08	0.06	0.04	0.03	0.02
0.40	0.26	0.18	0.13	0.11	0.08	0.06	0.04	0.03	0.02
0.42	0.26	0.18	0.13	0.12	0.08	0.06	0.04	0.03	0.02
0.44	0.26	0.18	0.13	0.12	0.08	0.06	0.04	0.03	0.02
0.46	0.26	0.18	0.13	0.12	0.08	0.06	0.04	0.03	0.02
0.48	0.26	0.18	0.13	0.12	0.08	0.06	0.04	0.03	0.02
0.50	0.26	0.18	0.13	0.12	0.08	0.06	0.04	0.03	0.02

Level of significance - 90 percent

Table F-3.

Conditional probabilities (expressed as percent chance) that an oil spill starting at a particular location (during the winter season) will contact a certain target within 3 days.

Target	Hypothetical Spill Location																							
	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L26	L27	L28	L29	L30	L31	L32	L33
Land	n	n	n	15	35	5	n	n	25	10	n	5	10	25	n	n	15	5	10	n	5	5	55	n	n
Sub. Res. Area A	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	64	n	n	n	n	n	n	n
Sub. Res. Area A - Spring	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	24	n	n	n	n	n	n	n
Sub. Res. Area B	n	n	n	**	80	n	n	n	n	n	n	n	n	n	n	n	n	**	**	14	25	n	n	n	n
Sub. Res. Area B - Spring	n	n	n	33	29	n	n	n	n	n	n	n	n	n	n	n	n	33	33	5	10	n	n	n	n
Sub. Res. Area C	n	n	n	n	n	n	n	n	n	53	n	28	25	**	47	n	70	n	n	n	n	n	n	**	n
Gray Whale Area - October	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	25	n	n	n	n	n	n	n
Gray Whale Area - April	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	33	14	n	n	n	n	n	n
Bhead Spring Mig. Cor. A	n	n	33	29	14	n	n	n	n	n	n	n	n	n	n	n	n	29	33	19	5	n	n	n	n
Bhead Spring Mig. Cor. B	n	n	n	n	5	24	33	33	n	5	33	n	n	n	5	n	n	n	n	33	19	5	n	5	n
Bhead Mig. Area A - Oct.	n	n	n	n	n	25	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	6	n	n	n
Bhead Mig. Area B - Oct.	n	n	n	n	n	n	n	n	n	25	n	25	19	6	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Seg. 1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Seg. 1 - Spring	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Seg. 2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	27	5	n	n	n	n	n	n
Ice/Sea Seg. 2 - Spring	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	10	n	n	n	n	n	n	n
Ice/Sea Seg. 3	n	n	31	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n
Ice/Sea Seg. 3 - Spring	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Seg. 4	n	n	n	47	14	n	n	n	n	n	n	n	n	n	n	n	n	n	14	19	6	n	n	n	n
Ice/Sea Seg. 4 - Spring	n	n	n	14	5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n
Ice/Sea Seg. 5	n	n	n	n	25	43	47	n	n	n	n	n	n	n	n	n	n	n	n	n	62	n	n	n	n
Ice/Sea Seg. 5 - Spring	n	n	n	n	5	24	19	n	n	n	n	n	n	n	n	n	n	n	n	n	14	n	n	n	n
Ice/Sea Seg. 6	n	n	n	n	n	77	n	19	n	n	n	n	n	n	n	n	n	n	n	n	n	11	n	n	n
Ice/Sea Seg. 7	n	n	n	n	n	n	n	9	14	6	9	n	n	n	n	n	n	n	n	n	n	20	14	n	n
Ice/Sea Seg. 8	n	n	n	n	n	n	n	n	n	38	**	22	13	n	n	n	n	n	n	n	n	n	9	n	n
Ice/Sea Seg. 9	n	n	n	n	n	n	n	n	n	19	n	81	62	22	n	n	n	n	n	n	n	n	n	37	n
Ice/Sea Seg. 10	n	n	n	n	n	n	n	n	n	n	n	n	16	20	47	19	n	n	n	n	n	n	n	47	n
Ice/Sea Seg. 11	n	n	n	n	n	n	n	n	n	n	n	n	n	n	86	n	41	n	n	n	n	n	n	n	n
Ice/Sea Seg. 12	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Seg. 13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Seg. 14	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	16

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent; Spring = April 1 through June 15.

Table F-4.

Conditional probabilities (expressed as percent chance) that an oil spill starting at a particular location (during the winter season) will contact a certain target within 10 days.

Target	Hypothetical Spill Location																							
	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L26	L27	L28	L29	L30	L31	L32	L33
Land	n	n	n	15	45	15	n	n	70	30	n	15	15	35	n	n	25	5	10	n	25	40	80	5	n
Sub. Res. Area A	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	64	n	n	n	n	n	n	n
Sub. Res. Area A - Spring	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	24	n	n	n	n	n	n	n
Sub. Res. Area B	n	n	n	**	84	30	14	n	5	5	n	n	n	n	n	n	n	**	**	19	39	16	n	n	n
Sub. Res. Area B - Spring	n	n	n	33	29	5	n	n	5	5	n	n	n	n	n	n	n	33	33	5	10	10	n	n	n
Sub. Res. Area C	n	n	n	n	n	n	n	n	n	53	n	33	30	**	47	n	70	n	n	n	n	n	n	**	n
Gray Whale Area - October	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	25	n	n	n	n	n	n	n
Gray Whale Area - April	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	33	14	n	n	n	n	n	n
Bhead Spring Mig. Cor. A	n	n	33	29	19	10	10	5	5	n	n	n	n	n	n	n	n	29	33	19	14	10	n	n	n
Bhead Spring Mig. Cor. B	n	n	n	n	5	79	33	33	5	14	33	24	24	19	29	33	24	n	n	33	19	19	n	29	n
Bhead Mig. Area A - Oct.	n	n	n	n	n	25	n	n	6	n	n	n	n	n	n	n	n	n	n	n	n	6	6	n	n
Bhead Mig. Area B - Oct.	n	n	n	n	n	n	n	n	n	25	n	25	19	6	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Seg. 1	n	n	5	20	n	n	n	n	n	n	n	n	n	n	n	n	n	31	20	n	n	n	n	n	n
Ice/Sea Seg. 1 - Spring	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	14	n	n	n	n	n	n	n
Ice/Sea Seg. 2	n	n	n	16	n	n	n	n	n	n	n	n	n	n	n	n	n	50	5	n	n	n	n	n	n
Ice/Sea Seg. 2 - Spring	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	19	n	n	n	n	n	n	n
Ice/Sea Seg. 3	n	n	31	39	23	11	10	n	n	n	n	n	n	n	n	n	n	6	28	34	31	n	n	n	n
Ice/Sea Seg. 3 - Spring	n	n	5	14	10	5	10	n	n	n	n	n	n	n	n	n	n	n	5	10	14	n	n	n	n
Ice/Sea Seg. 4	n	n	n	47	28	22	25	5	5	n	n	n	n	n	n	n	n	n	14	19	46	11	n	n	n
Ice/Sea Seg. 4 - Spring	n	n	n	14	5	5	10	5	5	n	n	n	n	n	n	n	n	n	n	5	24	5	n	n	n
Ice/Sea Seg. 5	n	n	n	n	25	56	47	14	9	n	n	n	n	n	n	n	n	n	n	n	62	25	5	n	n
Ice/Sea Seg. 5 - Spring	n	n	n	n	5	24	19	n	5	n	n	n	n	n	n	n	n	n	n	n	14	10	n	n	n
Ice/Sea Seg. 6	n	n	n	n	n	77	n	23	9	n	14	5	n	n	n	n	n	n	n	n	n	39	5	n	n
Ice/Sea Seg. 7	n	n	n	n	n	n	n	9	25	31	23	14	9	n	n	n	n	n	n	n	n	20	20	5	n
Ice/Sea Seg. 8	n	n	n	n	n	n	n	n	n	52	**	41	36	20	5	n	5	n	n	n	n	n	9	25	n
Ice/Sea Seg. 9	n	n	n	n	n	n	n	n	n	19	n	81	62	36	14	n	9	n	n	n	n	n	n	42	n
Ice/Sea Seg. 10	n	n	n	n	n	n	n	n	n	n	n	n	16	25	61	23	45	n	n	n	n	n	n	52	n
Ice/Sea Seg. 11	n	n	n	n	n	n	n	n	n	n	n	n	n	n	86	n	45	n	n	n	n	n	n	n	30
Ice/Sea Seg. 12	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	39
Ice/Sea Seg. 13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	19
Ice/Sea Seg. 14	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	16

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent. Spring = April 1 through June 15.

Table F-5.

Conditional probabilities (expressed as percent chance) that an oil spill starting at a particular location (during the winter season) will contact a certain target over the entire winter season.

Target	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L26	L27	L28	L29	L30	L31	L32	L33
	Hypothetical Spill Location																								
Land	n	n	n	15	45	20	n	n	70	35	n	15	15	35	5	n	30	5	10	n	25	40	80	5	10
Sub. Res. Area A	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	64	n	n	n	n	n	n	n
Sub. Res. Area A - Spring	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	24	n	n	n	n	n	n	n
Sub. Res. Area B	n	n	n	**	84	30	14	9	9	9	n	5	n	n	n	n	5	**	**	19	39	20	n	n	5
Sub. Res. Area B - Spring	n	n	n	33	29	5	n	n	5	5	n	n	n	n	n	n	5	33	33	5	10	10	n	n	5
Sub. Res. Area C	n	n	n	n	n	n	n	n	n	53	n	33	30	**	47	n	70	n	n	n	n	n	n	**	5
Gray Whale Area - October	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	25	n	n	n	n	n	n	n
Gray Whale Area - April	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	33	14	n	n	n	n	n	n
Bhead Spring Mig. Cor. A	n	n	33	29	19	10	10	5	5	n	n	n	n	n	n	n	5	29	33	19	14	10	n	n	n
Bhead Spring Mig. Cor. B	n	n	n	n	5	29	33	33	5	14	33	24	24	19	29	33	24	n	n	33	19	19	n	29	29
Bhead Mig. Area A - Oct.	n	n	n	n	n	25	n	n	6	n	n	n	n	n	n	n	n	n	n	n	n	6	6	n	n
Bhead Mig. Area B - Oct.	n	n	n	n	n	n	n	n	n	25	n	25	19	6	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Seg. 1	n	n	5	20	n	n	n	n	n	n	n	n	n	n	n	n	n	31	20	n	n	n	n	n	n
Ice/Sea Seg. 1 - Spring	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	14	n	n	n	n	n	n	n
Ice/Sea Seg. 2	n	n	n	16	n	n	n	n	n	n	n	n	n	n	n	n	n	50	5	n	n	n	n	n	n
Ice/Sea Seg. 2 - Spring	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	19	n	n	n	n	n	n	n
Ice/Sea Seg. 3	n	n	31	39	28	16	28	5	9	5	5	5	5	5	n	n	n	6	28	34	45	16	n	n	n
Ice/Sea Seg. 3 - Spring	n	n	5	14	10	5	10	n	5	n	n	n	n	n	n	n	n	n	5	10	14	5	n	n	n
Ice/Sea Seg. 4	n	n	n	47	28	22	25	19	9	n	n	5	5	n	n	n	5	n	14	19	46	16	n	n	n
Ice/Sea Seg. 4 - Spring	n	n	n	14	5	5	10	5	5	n	n	n	n	n	n	n	5	n	n	5	24	5	n	n	n
Ice/Sea Seg. 5	n	n	n	n	25	56	47	14	9	5	14	5	5	5	n	n	n	n	n	n	62	25	5	n	10
Ice/Sea Seg. 5 - Spring	n	n	n	n	5	24	19	n	5	n	n	n	n	n	n	n	n	n	n	n	14	10	n	n	10
Ice/Sea Seg. 6	n	n	n	n	n	77	n	23	9	5	14	19	14	5	n	n	n	n	n	n	n	39	5	n	n
Ice/Sea Seg. 7	n	n	n	n	n	n	n	9	25	31	23	14	14	9	9	n	n	n	n	n	n	20	20	14	n
Ice/Sea Seg. 8	n	n	n	n	n	n	n	n	n	52	**	41	36	25	9	n	9	n	n	n	n	n	9	25	n
Ice/Sea Seg. 9	n	n	n	n	n	n	n	n	n	19	n	81	62	36	14	n	9	n	n	n	n	n	n	42	n
Ice/Sea Seg. 10	n	n	n	n	n	n	n	n	n	n	n	n	16	25	61	23	45	n	n	n	n	n	n	52	23
Ice/Sea Seg. 11	n	n	n	n	n	n	n	n	n	n	n	n	n	n	86	n	45	n	n	n	n	n	n	n	30
Ice/Sea Seg. 12	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	39
Ice/Sea Seg. 13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	19
Ice/Sea Seg. 14	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	16

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent. Spring = April 1 through June 15.

Table F-6.

Conditional probabilities (expressed as percent chance) that an oil spill starting at a particular location (during the winter season) will contact a certain land segment within 3 days.

Land Segment	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L26	L27	L28	L29	L30	L31	L32	L33
	Hypothetical Spill Location																								
16	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n
20	n	n	n	10	15	n	n	n	n	n	n	n	n	n	n	n	n	n	10	n	n	n	n	n	n
21	n	n	n	5	15	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
23	n	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
24	n	n	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n
28	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n
33	n	n	n	n	n	n	n	n	10	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n
34	n	n	n	n	n	n	n	n	15	5	n	n	n	n	n	n	n	n	n	n	n	n	40	n	n
35	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	10	n	n
37	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n
38	n	n	n	n	n	n	n	n	n	n	n	5	5	n	n	n	n	n	n	n	n	n	n	n	n
41	n	n	n	n	n	n	n	n	n	n	n	n	n	15	n	n	n	n	n	n	n	n	n	n	n
42	n	n	n	n	n	n	n	n	n	n	n	n	n	10	n	n	10	n	n	n	n	n	n	n	n
43	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n
81	n	15	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
82	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Notes: ** = Greater than 99.5 percent; n = less than 0.5 percent.
Rows with all values less than 0.5 percent are not shown.

Table F-7.

Conditional probabilities (expressed as percent chance) that an oil spill starting at a particular location (during the winter season) will contact a certain land segment within 10 days.

Land Segment	Hypothetical Spill Location																							
	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L26	L27	L28	L29	L30	L31	L32	L33
16	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n
20	n	n	n	10	20	5	n	n	n	n	n	n	n	n	n	n	n	n	10	n	15	5	n	n	n
21	n	n	n	5	20	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
22	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n
23	n	n	n	n	5	5	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n
24	n	n	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n
27	n	n	n	n	n	n	n	n	10	n	n	n	n	n	n	n	n	n	n	n	n	10	n	n	n
28	n	n	n	n	n	n	n	n	25	5	n	n	n	n	n	n	n	n	n	n	n	20	10	n	n
29	n	n	n	n	n	n	n	n	10	n	n	5	n	n	n	n	n	n	n	n	n	n	15	n	n
30	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n
33	n	n	n	n	n	n	n	n	10	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n
34	n	n	n	n	n	n	n	n	15	10	n	n	5	n	n	n	n	n	n	n	n	n	40	n	n
35	n	n	n	n	n	n	n	n	n	10	n	n	n	n	n	n	n	n	n	n	n	n	10	n	n
36	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n
37	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n
38	n	n	n	n	n	n	n	n	n	n	n	5	5	5	n	n	5	n	n	n	n	n	n	n	n
39	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n
41	n	n	n	n	n	n	n	n	n	n	n	n	n	15	n	n	5	n	n	n	n	n	n	n	n
42	n	n	n	n	n	n	n	n	n	n	n	n	n	10	n	n	10	n	n	n	n	n	n	n	n
43	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n
81	n	15	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
82	n	20	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
83	5	10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
86	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
87	n	15	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
88	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Notes: ** = Greater than 99.5 percent; n = less than 0.5 percent.
Rows with all values less than 0.5 percent are not shown.

Table F-8.

Conditional probabilities (expressed as percent chance) that an oil spill starting at a particular location (during the winter season) will contact a certain land segment over the entire winter season.

Land Segment	Hypothetical Spill Location																							
	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L26	L27	L28	L29	L30	L31	L32	L33
16	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n
20	n	n	n	10	20	10	n	n	n	n	n	n	n	n	n	n	n	n	10	n	15	5	n	n	n
21	n	n	n	5	20	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
22	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n
23	n	n	n	n	5	5	n	n	n	5	n	n	n	n	n	n	5	n	n	n	n	5	n	n	5
24	n	n	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	5
27	n	n	n	n	n	n	n	n	10	5	n	n	n	n	n	n	n	n	n	n	n	10	n	n	n
28	n	n	n	n	n	n	n	n	25	5	n	n	n	n	n	n	n	n	n	n	n	20	10	n	n
29	n	n	n	n	n	n	n	n	10	n	n	5	n	n	n	n	n	n	n	n	n	n	15	n	n
30	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n	5	n
33	n	n	n	n	n	n	n	n	10	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n
34	n	n	n	n	n	n	n	n	15	10	n	n	5	n	n	n	n	n	n	n	n	n	40	n	n
35	n	n	n	n	n	n	n	n	n	10	n	n	n	n	n	n	n	n	n	n	n	n	10	n	n
36	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n
37	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n	n
38	n	n	n	n	n	n	n	n	n	n	n	5	5	5	n	n	5	n	n	n	n	n	n	n	n
39	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n	n	n	n
41	n	n	n	n	n	n	n	n	n	n	n	n	n	15	n	n	5	n	n	n	n	n	n	n	n
42	n	n	n	n	n	n	n	n	n	n	n	n	n	10	n	n	10	n	n	n	n	n	n	n	n
43	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n
73	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5
74	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	5	n	n	n	n	n	n	n	n	10
75	n	n	n	n	n	n	n	n	n	n	n	n	n	5	5	25	5	n	n	n	n	n	n	5	20
76	n	n	n	n	n	n	n	n	n	n	n	5	5	5	20	15	5	n	n	n	n	n	n	n	15
77	n	n	n	n	n	n	n	n	n	5	10	n	5	10	5	5	20	n	n	n	n	n	n	20	10
78	n	n	n	n	n	n	5	20	n	10	35	15	20	5	20	20	15	n	n	n	n	n	5	20	20
79	n	n	n	n	n	5	25	25	10	10	n	25	20	15	20	20	5	n	n	15	n	5	10	10	5
80	n	n	5	5	5	25	15	10	10	5	10	5	n	n	5	10	5	n	5	15	25	15	5	20	n
81	n	15	25	10	20	10	5	10	n	5	15	10	10	10	15	n	10	n	n	25	5	15	n	15	5
82	5	20	10	25	n	10	20	5	10	10	10	15	20	10	n	n	n	n	25	30	5	5	n	5	n
83	10	10	5	10	n	n	n	5	n	10	15	5	n	n	n	n	n	15	5	n	5	n	n	n	n
86	n	5	5	n	n	n	5	n	n	5	5	n	n	n	n	n	n	10	5	n	n	n	n	n	n
87	35	35	10	20	15	20	15	10	n	n	n	n	n	n	n	n	n	10	30	15	20	5	n	n	n
88	25	15	30	15	15	10	10	5	n	5	n	5	5	5	n	n	n	40	10	n	15	5	n	n	n
89	10	n	10	n	n	n	n	5	n	n	n	n	n	n	n	n	n	15	10	n	n	10	n	n	n
90	15	n	n	n	n	n	n	5	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n

Notes: ** = Greater than 99.5 percent; n = less than 0.5 percent.
Rows with all values less than 0.5 percent are not shown.

Table F-9.

Conditional probabilities (expressed as percent chance) that an oil spill starting at a particular location will contact a certain target within 3 days of a summer spill or melt out of an overwintering spill. Targets are contacted during the open-water season (approximately mid-July through September).

Target	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L26	L27	L28	L29	L30	L31	L32	L33
	Hypothetical Spill Location																								
Land	n	n	n	5	9	2	n	n	10	11	n	6	8	26	n	n	11	1	2	n	3	1	32	n	n
Sub. Res. Area A	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	19	n	n	n	n	n	n	n
Sub. Res. Area B	n	n	1	33	53	15	n	n	n	3	n	n	n	n	1	1	1	25	29	1	20	7	n	n	n
Sub. Res. Area C	n	n	n	n	n	n	n	n	2	18	n	16	18	47	12	n	30	n	n	n	n	n	3	21	n
Bhead Summer Feed. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	7
Bhead Fall Feed. Area A	n	n	n	22	37	8	n	n	n	6	n	n	n	n	n	n	n	n	1	n	21	9	n	n	n
Bhead Fall Feed. Area B	n	n	n	n	n	n	n	n	n	n	n	n	n	41	4	n	33	n	n	n	n	n	n	n	n
Bhead Mig. Area A	n	n	n	n	n	9	2	1	17	2	n	2	n	n	2	n	n	n	n	n	n	6	9	2	n
Bhead Mig. Area B	n	n	n	n	n	n	n	n	n	21	1	21	11	4	n	n	2	n	n	n	n	n	n	2	n
Fall Bowhead Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	21	n	n	n	n	n	n	n	1	n
Gray Whale Area	n	n	n	2	4	4	n	n	n	n	n	n	n	n	n	n	n	25	7	n	4	2	n	n	n
Seabird Offshore Area	n	n	21	28	30	8	n	n	n	1	n	n	n	8	8	12	8	21	28	21	17	5	n	n	n
Lagoon Area 1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n	n	n
Lagoon Area 2	n	n	n	11	16	9	n	n	n	1	n	n	n	n	n	n	n	n	15	n	12	5	n	n	n
Lagoon Area 3	n	n	n	n	n	n	n	n	36	13	n	2	4	n	n	n	n	n	n	n	n	12	56	n	n
Lagoon Area 4	n	n	n	n	n	n	n	n	n	2	n	5	8	4	n	n	4	n	n	n	n	n	n	n	n
Lagoon Area 5	n	n	n	n	n	n	n	n	n	n	n	n	1	29	n	n	10	n	n	n	n	n	n	1	n
Lagoon Area 6	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	4	n	n	n	n	n	n	n	n
Ice/Sea Segment 1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Segment 2	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	4	1	n	1	n	n	n	n
Ice/Sea Segment 3	n	n	2	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Segment 4	n	n	n	3	2	n	n	n	n	n	n	n	n	n	2	3	2	n	n	6	2	n	n	n	n
Ice/Sea Segment 5	n	n	n	n	n	8	6	n	13	3	n	2	n	n	2	n	n	n	n	n	10	10	7	2	n
Ice/Sea Segment 6	n	n	n	n	n	18	1	n	30	3	n	3	n	n	3	n	n	n	n	n	n	10	17	3	n
Ice/Sea Segment 7	n	n	n	n	n	n	n	3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Segment 8	n	n	n	n	n	n	n	n	n	2	21	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Segment 9	n	n	n	n	n	n	n	n	n	n	n	8	6	2	n	n	2	n	n	n	n	n	n	8	n
Ice/Sea Segment 10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	2	n
Ice/Sea Segment 11	n	n	n	n	n	n	n	n	n	n	n	n	n	n	14	1	1	n	n	n	n	n	n	n	n
Ice/Sea Segment 12	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Segment 13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Segment 14	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent.

Table F-10.

Conditional probabilities (expressed as percent chance) that an oil spill starting at a particular location will contact a certain target within 10 days of a summer spill or melt out of an overwintering spill. Targets are contacted during the open-water season (approximately mid-July through September).

Target	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L26	L27	L28	L29	L30	L31	L32	L33
	Hypothetical Spill Location																								
Land	n	n	n	7	25	10	n	n	38	29	n	18	21	35	2	n	22	4	3	n	10	21	60	3	n
Sub. Res. Area A	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	20	n	n	n	n	n	n	n
Sub. Res. Area B	n	n	1	33	55	22	1	n	12	8	n	2	n	1	2	2	2	25	29	4	35	21	6	2	n
Sub. Res. Area C	n	n	n	n	n	n	n	n	2	18	n	20	25	48	13	n	35	n	n	n	n	n	3	21	n
Bhead Summer Feed. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	14
Bhead Fall Feed. Area A	n	n	n	22	37	11	n	n	6	6	n	1	n	n	1	n	n	n	1	n	23	13	3	1	n
Bhead Fall Feed. Area B	n	n	n	n	n	n	n	n	n	n	n	n	n	41	5	n	33	n	n	n	n	n	n	n	n
Bhead Mig. Area A	n	n	n	n	n	10	2	3	18	4	n	2	n	n	2	n	n	n	n	n	n	7	11	2	n
Bhead Mig. Area B	n	n	n	n	n	n	n	n	n	21	1	21	14	10	2	n	6	n	n	n	n	n	n	6	n
Fall Bowhead Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	9	21	1	n	n	n	n	n	n	2	n
Gray Whale Area	n	n	n	4	8	4	n	n	n	n	n	n	n	n	n	n	n	25	8	n	5	2	n	n	n
Seabird Offshore Area	n	n	21	28	35	22	7	n	22	6	n	2	n	8	10	12	8	23	28	21	31	20	13	2	n
Lagoon Area 1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n
Lagoon Area 2	n	n	n	11	27	13	n	n	1	3	n	n	n	n	n	n	n	n	15	n	15	8	1	n	n
Lagoon Area 3	n	n	n	n	n	n	n	n	36	19	n	7	6	1	n	n	1	n	n	n	n	13	56	n	n
Lagoon Area 4	n	n	n	n	n	n	n	n	n	3	n	10	12	8	n	n	6	n	n	n	n	n	n	1	n
Lagoon Area 5	n	n	n	n	n	n	n	n	n	n	n	n	2	30	1	n	17	n	n	n	n	n	n	1	n
Lagoon Area 6	n	n	n	n	n	n	n	n	n	n	n	n	n	2	1	n	6	n	n	n	n	n	n	n	n
Ice/Sea Segment 1	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n
Ice/Sea Segment 2	n	n	n	2	5	3	n	n	n	n	n	n	n	n	n	n	n	9	6	n	4	2	n	n	n
Ice/Sea Segment 3	n	n	6	3	2	n	n	n	n	n	n	n	n	2	4	6	4	n	2	10	2	n	n	n	n
Ice/Sea Segment 4	n	n	n	4	5	7	4	n	11	3	n	2	n	n	4	4	3	n	n	7	13	10	6	2	n
Ice/Sea Segment 5	n	n	n	1	1	16	8	n	28	6	n	3	n	n	3	n	n	n	n	n	14	18	15	3	n
Ice/Sea Segment 6	n	n	n	n	n	18	2	3	32	3	n	3	n	n	3	n	n	n	n	n	n	13	17	3	n
Ice/Sea Segment 7	n	n	n	n	n	n	n	4	1	2	4	2	n	n	n	n	n	n	n	n	n	1	1	n	n
Ice/Sea Segment 8	n	n	n	n	n	n	n	n	n	3	21	4	3	2	1	n	1	n	n	n	n	n	1	6	n
Ice/Sea Segment 9	n	n	n	n	n	n	n	n	n	1	n	9	7	6	3	n	5	n	n	n	n	n	n	12	n
Ice/Sea Segment 10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	12	5	2	n	n	n	n	n	n	4	n
Ice/Sea Segment 11	n	n	n	n	n	n	n	n	n	n	n	n	n	1	14	1	2	n	n	n	n	n	n	n	n
Ice/Sea Segment 12	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5
Ice/Sea Segment 13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Segment 14	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent.

Table F-11.

Conditional probabilities (expressed as percent chance) that an oil spill starting at a particular location will contact a certain target within 30 days of a summer spill or melt out of an overwintering spill. Targets are contacted during the open-water season (approximately mid-July through September).

Target	Hypothetical Spill Location																							
	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L26	L27	L28	L29	L30	L31	L32	L33
Land	n	n	n	7	25	12	n	n	46	36	n	23	26	42	4	n	31	4	3	n	12	28	67	5	4
Sub. Res. Area A	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	20	n	n	n	n	n	n	n
Sub. Res. Area B	n	n	1	33	55	26	6	n	21	10	n	3	n	1	3	2	2	25	29	4	36	28	11	2	n
Sub. Res. Area C	n	n	n	n	n	n	n	n	2	18	n	20	25	48	13	n	35	n	n	n	n	n	3	21	4
Bhead Summer Feed. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	14
Bhead Fall Feed. Area A	n	n	n	22	37	12	1	n	9	8	n	1	n	n	1	n	n	n	1	n	23	16	5	1	n
Bhead Fall Feed. Area B	n	n	n	n	n	n	n	n	n	n	n	n	n	41	5	n	33	n	n	n	n	n	n	n	6
Bhead Mig. Area A	n	n	n	n	n	10	2	3	18	5	2	5	3	1	2	n	2	n	n	n	n	7	11	4	n
Bhead Mig. Area B	n	n	n	n	n	n	n	n	n	21	1	21	14	10	2	n	8	n	n	n	n	n	n	7	1
Fall Bowhead Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	9	21	3	n	n	n	n	n	n	2	13
Gray Whale Area	n	n	n	4	8	4	n	n	1	1	n	n	n	n	n	n	n	25	8	n	6	4	1	n	n
Seabird Offshore Area	n	n	21	28	35	25	13	4	29	8	n	4	n	8	11	12	8	23	28	21	31	25	15	3	n
Lagoon Area 1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n	n	n	n	n	n
Lagoon Area 2	n	n	n	11	27	14	n	n	3	4	n	n	n	n	n	n	n	n	15	n	16	11	2	n	n
Lagoon Area 3	n	n	n	n	n	n	n	n	36	20	n	7	7	2	n	n	1	n	n	n	n	13	56	1	n
Lagoon Area 4	n	n	n	n	n	n	n	n	n	3	n	10	12	8	1	n	7	n	n	n	n	n	n	2	n
Lagoon Are.. 5	n	n	n	n	n	n	n	n	n	n	n	n	2	30	2	n	18	n	n	n	n	n	n	1	n
Lagoon Area 6	n	n	n	n	n	n	n	n	n	n	n	n	n	2	1	n	6	n	n	n	n	n	n	n	1
Ice/Sea Segment 1	1	n	n	3	5	2	n	n	n	n	n	n	n	n	n	n	n	11	6	n	4	2	n	n	n
Ice/Sea Segment 2	n	n	n	3	5	4	n	n	2	n	n	n	n	n	n	n	n	9	6	n	4	3	1	n	n
Ice/Sea Segment 3	n	n	6	5	5	11	8	n	19	4	n	3	n	2	7	8	6	n	2	14	10	12	10	2	n
Ice/Sea Segment 4	n	n	n	4	5	12	9	2	20	5	n	3	n	n	5	4	3	n	n	7	13	15	11	2	n
Ice/Sea Segment 5	n	n	n	1	1	16	9	4	29	7	1	5	1	1	3	n	1	n	n	n	14	19	16	4	n
Ice/Sea Segment 6	n	n	n	n	n	18	2	4	33	7	5	6	3	1	4	n	2	n	n	n	n	13	19	5	n
Ice/Sea Segment 7	n	n	n	n	n	n	n	4	1	3	5	3	3	3	3	n	3	n	n	n	n	1	1	5	n
Ice/Sea Segment 8	n	n	n	n	n	n	n	n	n	4	21	5	5	4	3	1	4	n	n	n	n	n	1	8	n
Ice/Sea Segment 9	n	n	n	n	n	n	n	n	n	1	n	9	7	7	4	n	7	n	n	n	n	n	n	12	1
Ice/Sea Segment 10	n	n	n	n	n	n	n	n	n	n	n	n	n	1	13	6	4	n	n	n	n	n	n	4	7
Ice/Sea Segment 11	n	n	n	n	n	n	n	n	n	n	n	n	n	1	14	1	3	n	n	n	n	n	n	n	11
Ice/Sea Segment 12	n	n	n	n	n	n	n	n	n	n	n	n	n	r	n	n	n	n	n	n	n	n	n	n	11
Ice/Sea Segment 13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Ice/Sea Segment 14	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent.

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Table F-12.

Conditional probabilities (expressed as percent chance) that an oil spill starting at a particular location will contact a certain land segment within 3 days of a summer spill or melt out of an overwintering spill. Segments are contacted during the open-water season (approximately mid-July through September).

Land Segment	Hypothetical Spill Location																							
	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L26	L27	L28	L29	L30	L31	L32	L33
15	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n
19	n	n	n	1	2	1	n	n	n	n	n	n	n	n	n	n	n	n	1	n	2	n	n	n	n
20	n	n	n	4	2	n	n	n	n	n	n	n	n	n	r	n	n	n	1	n	2	n	n	n	n
22	n	n	n	n	1	n	n	n	n	n	n	n	n	n	u	n	n	n	n	n	n	n	n	n	n
23	n	n	n	n	3	1	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n
32	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
33	n	n	n	n	n	n	n	n	2	1	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n
34	n	n	n	n	n	n	n	n	8	8	n	3	1	n	n	n	n	n	n	n	n	n	27	n	n
35	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
37	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n
38	n	n	n	n	n	n	n	n	n	n	n	2	6	2	n	n	2	n	n	n	n	n	n	n	n
41	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n	1	n	n	n	n	n	n	n	n
42	n	n	n	n	n	n	n	n	n	n	n	n	n	20	n	n	6	n	n	n	n	n	n	n	n
83	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
87	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

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Notes: ** = Greater than 99.5 percent; n = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table F-13.

Conditional probabilities (expressed as percent chance) that an oil spill starting at a particular location will contact a certain land segment within 10 days of a summer spill or melt out of an overwintering spill. Segments are contacted during the open-water season (approximately mid-July through September).

Land Segment	Hypothetical Spill Location																							
	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L26	L27	L28	L29	L30	L31	L32	L33
15	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n	n	n
19	n	n	n	1	2	1	n	n	n	n	n	n	n	n	n	n	n	n	1	n	2	1	n	n	n
20	n	n	n	5	10	2	n	n	n	1	n	n	n	n	n	n	n	n	1	n	3	2	n	n	n
21	n	n	n	n	5	2	n	n	1	1	n	n	n	n	n	n	n	n	n	n	n	2	1	n	n
22	n	n	n	n	3	1	n	n	1	1	n	n	n	n	n	n	n	n	n	n	n	1	1	n	n
23	n	n	n	n	4	2	n	n	2	1	n	n	n	n	n	n	n	n	n	n	1	2	1	n	n
24	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	1	n	n	n
26	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
27	n	n	n	n	n	1	n	n	5	1	n	n	n	n	n	n	n	n	n	n	n	5	4	n	n
28	n	n	n	n	n	n	n	n	8	2	n	n	1	n	n	n	n	n	n	n	n	6	7	n	n
29	n	n	n	n	n	n	n	n	7	2	n	n	1	n	n	n	n	n	n	n	n	1	8	n	n
30	n	n	n	n	n	n	n	n	3	1	n	n	1	n	n	n	n	n	n	n	n	n	4	n	n
31	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
32	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n
33	n	n	n	n	n	n	n	n	2	1	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n
34	n	n	n	n	n	n	n	n	8	11	n	4	2	n	n	n	n	n	n	n	n	n	27	n	n
35	n	n	n	n	n	n	n	n	n	4	n	2	2	n	n	n	n	n	n	n	n	n	3	n	n
36	n	n	n	n	n	n	n	n	n	1	n	1	2	n	n	n	1	n	n	n	n	n	n	n	n
37	n	n	n	n	n	n	n	n	n	2	n	1	2	1	n	n	1	n	n	n	n	n	n	n	n
38	n	n	n	n	n	n	n	n	n	n	n	7	9	6	n	n	4	n	n	n	n	n	n	1	n
39	n	n	n	n	n	n	n	n	n	n	n	1	1	2	n	n	1	n	n	n	n	n	n	n	n
40	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n
41	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n	3	n	n	n	n	n	n	n	n
42	n	n	n	n	n	n	n	n	n	n	n	n	n	20	n	n	8	n	n	n	n	n	n	n	n
43	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n
44	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n
45	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n
75	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1
82	n	2	n	n	n	n	n	n	n	1	1	1	1	n	n	n	n	n	n	n	n	n	n	1	n
83	n	1	n	n	n	n	n	2	n	1	2	1	1	n	n	n	n	n	n	n	n	n	n	1	n
86	n	n	n	n	n	1	2	1	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n
87	n	n	n	n	n	3	9	3	n	n	n	n	n	n	n	n	n	n	n	n	n	6	n	n	n
88	n	n	n	n	n	1	2	2	n	n	1	n	n	n	n	n	n	n	n	n	n	2	n	n	n
89	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Notes: ** = Greater than 99.5 percent; n = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table F-14.

Conditional probabilities (expressed as percent chance) that an oil spill starting at a particular location will contact a certain land segment within 30 days of a summer spill or melt out of an overwintering spill. Segments are contacted during the open-water season (approximately mid-July through September).

Land Segment	Hypothetical Spill Location																							
	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L26	L27	L28	L29	L30	L31	L32	L33
15	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n	n	n
19	n	n	n	1	2	1	n	n	n	n	n	n	n	n	n	n	n	n	1	n	2	1	n	n	n
20	n	n	n	5	10	3	n	n	2	2	n	n	n	n	n	n	n	n	1	n	5	3	1	n	n
21	n	n	n	n	5	2	n	n	1	1	n	n	n	n	n	n	n	n	n	n	n	2	1	n	n
22	n	n	n	n	3	1	n	n	1	1	n	n	n	n	n	n	n	n	n	n	n	1	1	n	n
23	n	n	n	n	4	2	n	n	3	1	n	n	n	n	n	n	n	n	n	n	2	3	2	n	n
24	n	n	n	n	n	n	n	n	2	1	n	n	n	n	n	n	n	n	n	n	1	2	2	n	n
25	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
26	n	n	n	n	1	n	n	n	1	1	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n
27	n	n	n	n	n	1	n	n	5	2	n	n	n	n	n	n	n	n	n	n	n	5	4	n	n
28	n	n	n	n	n	n	n	n	9	4	n	3	1	1	n	n	n	n	n	n	n	8	8	n	n
29	n	n	n	n	n	n	n	n	7	3	n	n	1	n	n	n	n	n	n	n	n	1	10	n	n
30	n	n	n	n	n	n	n	n	3	2	n	n	1	n	n	n	n	n	n	n	n	n	4	n	n
31	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
32	n	n	n	n	n	n	n	n	2	1	n	n	n	1	n	n	n	n	n	n	n	n	2	n	n
33	n	n	n	n	n	n	n	n	2	1	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n
34	n	n	n	n	n	n	n	n	8	11	n	4	3	n	n	n	n	n	n	n	n	n	27	1	n
35	n	n	n	n	n	n	n	n	n	4	n	2	3	1	n	n	1	n	n	n	n	n	3	n	n
36	n	n	n	n	n	n	n	n	n	1	n	1	3	2	n	n	1	n	n	n	n	n	n	n	n
37	n	n	n	n	n	n	n	n	n	2	n	2	2	1	n	n	1	n	n	n	n	n	n	1	n
38	n	n	n	n	n	n	n	n	n	n	n	7	9	7	1	n	7	n	n	n	n	n	n	1	n
39	n	n	n	n	n	n	n	n	n	n	n	1	1	3	n	n	3	n	n	n	n	n	n	n	n
40	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n
41	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n	4	n	n	n	n	n	n	n	n
42	n	n	n	n	n	n	n	n	n	n	n	n	n	20	n	n	8	n	n	n	n	n	n	n	n
43	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n
44	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n
45	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n
48	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1
75	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1
76	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2
77	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2
78	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	4
79	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2
81	n	n	1	1	1	n	n	n	n	n	n	n	n	n	1	2	1	n	n	3	1	n	n	n	n
82	n	3	1	2	2	1	n	n	n	1	1	1	1	1	1	1	1	n	2	1	1	n	n	1	n
83	n	2	1	1	1	1	n	2	n	1	2	1	1	1	n	n	n	n	2	n	1	n	n	1	n
86	1	1	n	n	n	1	2	1	n	1	1	1	1	n	n	n	n	n	n	n	n	1	n	1	n
87	6	9	n	n	n	3	9	6	n	3	5	3	3	n	n	n	n	n	n	n	n	6	n	3	n
88	4	3	1	n	n	1	2	2	n	2	2	2	2	n	n	n	n	n	n	n	n	2	n	2	n
89	3	3	1	n	n	n	n	1	n	1	2	1	1	n	n	n	n	n	n	n	n	n	n	1	n

Notes: ** = Greater than 99.5 percent; n = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table F-15.

Combined probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, proposed lease offering versus Barrow Deferral Alternative versus the cumulative case (proposal plus existing, including Canadian oil). Probabilities are for spills 1,000 barrels or greater. Results are based on winter trajectories only. (Offshore spills in winter from Lisburne Field in the cumulative case are assumed to contact land.)

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Target	------- Within 3 days ---------						------- Within 10 days --------						-------- Entire winter --------					
	PROPOSAL WINTER CASE		ALTERNAT BARROW WINTER		CUMULATV CASE WINTER		PROPOSAL WINTER CASE		ALTERNAT BARROW WINTER		CUMULATV CASE WINTER		PROPOSAL WINTER CASE		ALTERNAT BARROW WINTER		CUMULATV CASE WINTER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	14	0.1	13	0.1	70	1.2	26	0.3	26	0.3	89	2.2	28	0.3	27	0.3	96	3.2
Sub. Res. Area A	4	0.0	2	0.0	4	0.0	4	0.0	2	0.0	4	0.0	4	0.0	2	0.0	4	0.0
Sub. Res. Area A - Spring	2	0.0	1	0.0	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	1	0.0	2	0.0
Sub. Res. Area B	25	0.3	21	0.2	39	0.5	30	0.4	27	0.3	51	0.7	32	0.4	29	0.3	71	1.3
Sub. Res. Area B - Spring	9	0.1	8	0.1	16	0.2	11	0.1	10	0.1	24	0.3	12	0.1	10	0.1	51	0.7
Sub. Res. Area C	24	0.3	24	0.3	52	0.7	24	0.3	24	0.3	53	0.8	24	0.3	24	0.3	70	1.2
Gray Whale Area - October	2	0.0	1	0.0	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	1	0.0	2	0.0
Gray Whale Area - April	3	0.0	2	0.0	3	0.0	3	0.0	2	0.0	3	0.0	3	0.0	2	0.0	3	0.0
Bhead Spring Mig. Cor. A	10	0.1	9	0.1	16	0.2	14	0.2	12	0.1	27	0.3	14	0.2	12	0.1	27	0.3
Bhead Spring Mig. Cor. B	12	0.1	12	0.1	25	0.3	22	0.2	22	0.2	47	0.6	22	0.2	22	0.2	96	3.3
Bhead Mig. Area A - Oct.	2	0.0	2	0.0	5	0.1	3	0.0	3	0.0	16	0.2	3	0.0	3	0.0	16	0.2
Bhead Mig. Area B - Oct.	8	0.1	8	0.1	19	0.2	8	0.1	8	0.1	19	0.2	8	0.1	8	0.1	19	0.2
Ice/Sea Seg. 1	n	0.0	n	0.0	n	0.0	4	0.0	3	0.0	6	0.1	4	0.0	3	0.0	6	0.1
Ice/Sea Seg. 1 - Spring	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0
Ice/Sea Seg. 2	2	0.0	1	0.0	2	0.0	4	0.0	3	0.0	5	0.1	4	0.0	3	0.0	5	0.1
Ice/Sea Seg. 2 - Spring	1	0.0	n	0.0	1	0.0	2	0.0	1	0.0	2	0.0	2	0.0	1	0.0	2	0.0
Ice/Sea Seg. 3	3	0.0	3	0.0	4	0.0	15	0.2	13	0.1	26	0.3	21	0.2	20	0.2	42	0.6
Ice/Sea Seg. 3 - Spring	n	0.0	n	0.0	1	0.0	5	0.1	5	0.1	10	0.1	6	0.1	6	0.1	15	0.2
Ice/Sea Seg. 4	7	0.1	6	0.1	12	0.1	15	0.2	15	0.2	32	0.4	17	0.2	17	0.2	39	0.5
Ice/Sea Seg. 4 - Spring	2	0.0	2	0.0	4	0.0	6	0.1	5	0.1	15	0.2	6	0.1	6	0.1	16	0.2
Ice/Sea Seg. 5	13	0.1	13	0.1	27	0.3	17	0.2	17	0.2	42	0.5	19	0.2	19	0.2	78	1.5
Ice/Sea Seg. 5 - Spring	5	0.0	5	0.0	10	0.1	6	0.1	6	0.1	16	0.2	6	0.1	6	0.1	65	1.1
Ice/Sea Seg. 6	7	0.1	7	0.1	16	0.2	11	0.1	11	0.1	34	0.4	14	0.2	14	0.2	39	0.5
Ice/Sea Seg. 7	5	0.0	5	0.0	31	0.4	13	0.1	13	0.1	52	0.7	14	0.1	14	0.1	54	0.8
Ice/Sea Seg. 8	15	0.2	15	0.2	39	0.5	22	0.2	22	0.2	51	0.7	22	0.2	22	0.2	52	0.7
Ice/Sea Seg. 9	17	0.2	17	0.2	38	0.5	18	0.2	18	0.2	41	0.5	18	0.2	18	0.2	41	0.5
Ice/Sea Seg. 10	5	0.1	5	0.1	16	0.2	8	0.1	8	0.1	22	0.2	8	0.1	8	0.1	91	2.4
Ice/Sea Seg. 11	5	0.0	5	0.0	14	0.1	5	0.1	5	0.1	95	2.9	5	0.1	5	0.1	95	2.9
Ice/Sea Seg. 12	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	97	3.6	n	0.0	n	0.0	97	3.6
Ice/Sea Seg. 13	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	82	1.7	n	0.0	n	0.0	82	1.7
Ice/Sea Seg. 14	n	0.0	n	0.0	76	1.4	n	0.0	n	0.0	76	1.4	n	0.0	n	0.0	76	1.4

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Spring = April 1 through June 15.

Table F-16.

Combined probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Barrow Deferral Alternative versus Chukchi Deferral Alternative versus Kaktovik Deferral Alternative. Probabilities are for spills 1,000 barrels or greater. Results are based on winter trajectories only.

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Target	------- Within 3 days ---------						------- Within 10 days --------						-------- Entire winter --------					
	DEFERRAL ALTERNATIVE						DEFERRAL ALTERNATIVE						DEFERRAL ALTERNATIVE					
	BARROW WINTER		CHUKCHI WINTER		KAKTOVIK WINTER		BARROW WINTER		CHUKCHI WINTER		KAKTOVIK WINTER		BARROW WINTER		CHUKCHI WINTER		KAKTOVIK WINTER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	13	0.1	13	0.1	11	0.1	26	0.3	26	0.3	23	0.3	27	0.3	27	0.3	24	0.3
Sub. Res. Area A	2	0.0	2	0.0	4	0.0	2	0.0	2	0.0	4	0.0	2	0.0	2	0.0	4	0.0
Sub. Res. Area A - Spring	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0
Sub. Res. Area B	21	0.2	22	0.2	25	0.3	27	0.3	28	0.3	30	0.4	29	0.3	29	0.3	32	0.4
Sub. Res. Area B - Spring	8	0.1	8	0.1	9	0.1	10	0.1	10	0.1	11	0.1	10	0.1	10	0.1	11	0.1
Sub. Res. Area C	24	0.3	24	0.3	12	0.1	24	0.3	24	0.3	13	0.1	24	0.3	24	0.3	13	0.1
Gray Whale Area - October	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0
Gray Whale Area - April	2	0.0	1	0.0	3	0.0	2	0.0	1	0.0	3	0.0	2	0.0	1	0.0	3	0.0
Bhead Spring Mig. Cor. A	9	0.1	7	0.1	10	0.1	12	0.1	11	0.1	14	0.2	12	0.1	11	0.1	14	0.2
Bhead Spring Mig. Cor. B	12	0.1	12	0.1	12	0.1	22	0.2	22	0.2	17	0.2	22	0.2	22	0.2	17	0.2
Bhead Mig. Area A - Oct.	2	0.0	2	0.0	2	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
Bhead Mig. Area B - Oct.	8	0.1	8	0.1	5	0.1	8	0.1	8	0.1	5	0.1	8	0.1	8	0.1	5	0.1
Ice/Sea Seg. 1	n	0.0	n	0.0	n	0.0	3	0.0	3	0.0	4	0.0	3	0.0	3	0.0	4	0.0
Ice/Sea Seg. 1 - Spring	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Ice/Sea Seg. 2	1	0.0	1	0.0	2	0.0	3	0.0	2	0.0	4	0.0	3	0.0	2	0.0	4	0.0
Ice/Sea Seg. 2 - Spring	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0
Ice/Sea Seg. 3	3	0.0	1	0.0	3	0.0	13	0.1	12	0.1	15	0.2	20	0.2	18	0.2	20	0.2
Ice/Sea Seg. 3 - Spring	n	0.0	n	0.0	n	0.0	5	0.1	5	0.0	5	0.1	6	0.1	6	0.1	6	0.1
Ice/Sea Seg. 4	6	0.1	7	0.1	7	0.1	15	0.2	15	0.2	15	0.2	17	0.2	17	0.2	17	0.2
Ice/Sea Seg. 4 - Spring	2	0.0	2	0.0	2	0.0	5	0.1	6	0.1	6	0.1	6	0.1	6	0.1	6	0.1
Ice/Sea Seg. 5	13	0.1	13	0.1	13	0.1	17	0.2	17	0.2	17	0.2	19	0.2	19	0.2	19	0.2
Ice/Sea Seg. 5 - Spring	5	0.0	5	0.0	5	0.0	6	0.1	6	0.1	6	0.1	6	0.1	6	0.1	6	0.1
Ice/Sea Seg. 6	7	0.1	7	0.1	7	0.1	11	0.1	11	0.1	11	0.1	14	0.2	14	0.2	13	0.1
Ice/Sea Seg. 7	5	0.0	5	0.0	4	0.0	13	0.1	13	0.1	10	0.1	14	0.1	14	0.1	11	0.1
Ice/Sea Seg. 8	15	0.2	15	0.2	12	0.1	22	0.2	22	0.2	16	0.2	22	0.2	22	0.2	16	0.2
Ice/Sea Seg. 9	17	0.2	17	0.2	9	0.1	18	0.2	18	0.2	9	0.1	18	0.2	18	0.2	9	0.1
Ice/Sea Seg. 10	5	0.1	5	0.1	2	0.0	8	0.1	8	0.1	3	0.0	8	0.1	8	0.1	3	0.0
Ice/Sea Seg. 11	5	0.0	5	0.0	4	0.0	5	0.1	5	0.1	4	0.0	5	0.1	5	0.1	4	0.0
Ice/Sea Seg. 12	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 13	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 14	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Spring = April 1 through June 15.

Table F-17.

Combined probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, proposed lease offering versus Barrow Deferral Alternative versus the cumulative case (proposal plus existing, including Canadian oil). Probabilities are for spills 1,000 barrels or greater. Results are based on winter trajectories only. (Offshore spills in winter from Lisburne Field in the cumulative case are assumed to contact Land Segment 34.)

	------- Within 3 days ---------						------- Within 10 days --------						-------- Entire winter --------					
Land Segment	PROPOSAL WINTER CASE		ALTERNAT BARROW WINTER		CUMULATV CASE WINTER		PROPOSAL WINTER CASE		ALTERNAT BARROW WINTER		CUMULATV CASE WINTER		PROPOSAL WINTER CASE		ALTERNAT BARROW WINTER		CUMULATV CASE WINTER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
20	3	0.0	3	0.0	5	0.1	5	0.1	5	0.1	11	0.1	6	0.1	6	0.1	12	0.1
21	2	0.0	2	0.0	5	0.0	3	0.0	3	0.0	6	0.1	3	0.0	3	0.0	6	0.1
22	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
23	1	0.0	1	0.0	1	0.0	2	0.0	2	0.0	5	0.1	2	0.0	2	0.0	41	0.5
24	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	38	0.5
27	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	12	0.1	2	0.0	2	0.0	14	0.1
28	n	0.0	n	0.0	1	0.0	4	0.0	4	0.0	34	0.4	4	0.0	4	0.0	34	0.4
29	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	22	0.3	1	0.0	1	0.0	22	0.3
30	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
33	1	0.0	1	0.0	14	0.1	1	0.0	1	0.0	14	0.1	1	0.0	1	0.0	14	0.1
34	2	0.0	2	0.0	50	0.7	3	0.0	3	0.0	52	0.7	3	0.0	3	0.0	52	0.7
35	1	0.0	1	0.0	11	0.1	2	0.0	2	0.0	13	0.1	2	0.0	2	0.0	13	0.1
36	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
37	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
38	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	3	0.0	1	0.0	1	0.0	3	0.0
39	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
41	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	3	0.0	1	0.0	1	0.0	3	0.0
42	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0
73	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	37	0.5
74	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	61	0.9
75	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	85	1.9
76	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	77	1.5
77	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	4	0.0	4	0.0	65	1.0
78	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	10	0.1	10	0.1	89	2.2
79	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	12	0.1	12	0.1	61	0.9
80	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	12	0.1	12	0.1	35	0.4
81	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	16	0.2	15	0.2	57	0.8
82	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	2	0.0	16	0.2	15	0.2	35	0.4
83	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	2	0.0	8	0.1	8	0.1	15	0.2
86	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	3	0.0	5	0.1
87	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	18	0.2	17	0.2	27	0.3
88	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	18	0.2	16	0.2	27	0.3
89	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	5	0.0	4	0.0	7	0.1
90	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	3	0.0	4	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table F-18.

Combined probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Barrow Deferral Alternative versus Chukchi Deferral Alternative versus Kaktovik Deferral Alternative. Probabilities are for spills 1,000 barrels or greater. Results are based on winter trajectories only.

	------- Within 3 days ---------						------- Within 10 days --------						-------- Entire winter --------					
	DEFERRAL ALTERNATIVE						DEFERRAL ALTERNATIVE						DEFFERAL ALTERNATIVE					
Land Segment	BARROW WINTER		CHUKCHI WINTER		KAKTOVIK WINTER		BARROW WINTER		CHUKCHI WINTER		KAKTOVIK WINTER		BARROW WINTER		CHUKCHI WINTER		KAKTOVIK WINTER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
20	3	0.0	3	0.0	3	0.0	5	0.1	5	0.1	5	0.1	6	0.1	6	0.1	6	0.1
21	2	0.0	2	0.0	2	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
23	1	0.0	1	0.0	1	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
24	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
27	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
28	n	0.0	n	0.0	n	0.0	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0
29	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
33	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
34	2	0.0	2	0.0	2	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
35	1	0.0	1	0.0	1	0.0	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	1	0.0
36	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0
38	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0
41	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0
42	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0
75	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0
76	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	1	0.0
77	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	4	0.0	4	0.0	2	0.0
78	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	10	0.1	10	0.1	7	0.1
79	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	12	0.1	12	0.1	9	0.1
80	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	12	0.1	12	0.1	11	0.1
81	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0	1	0.0	15	0.2	13	0.1	14	0.1
82	n	0.0	n	0.0	n	0.0	2	0.0	n	0.0	2	0.0	15	0.2	13	0.1	13	0.1
83	n	0.0	n	0.0	n	0.0	2	0.0	n	0.0	2	0.0	8	0.1	5	0.1	8	0.1
86	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	2	0.0	3	0.0
87	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	1	0.0	17	0.2	10	0.1	18	0.2
88	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	16	0.2	10	0.1	17	0.2
89	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	4	0.0	2	0.0	5	0.0
90	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	n	0.0	3	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table F-19.

Combined probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, proposed lease offering versus Barrow Deferral Alternative versus the cumulative case (proposal plus existing, including Canadian oil). Probabilities are for spills 1,000 barrels and greater. Results are based on open-water trajectories only; for contacts within 3, 10, and 30 days of summer spills or melt out of overwintering spills. (Offshore spills in summer from the Lisburne Field are assumed to contact land.)

Target	------- Within 3 days ---------						------- Within 10 days --------						------- Within 30 days --------					
	PROPOSAL OPNWATER CASE		ALTERNAT BARROW OPNWATER		CUMULATV OPNWATER CASE		PROPOSAL OPNWATER CASE		ALTERNAT BARROW OPNWATER		CUMULATV OPNWATER CASE		PROPOSAL OPNWATER CASE		ALTERNAT BARROW OPNWATER		CUMULATV OPNWATER CASE	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	8	0.1	8	0.1	45	0.6	20	0.2	20	0.2	76	1.4	23	0.3	23	0.3	88	2.1
Sub. Res. Area A	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0
Sub. Res. Area B	15	0.2	13	0.1	27	0.3	19	0.2	18	0.2	45	0.6	21	0.2	20	0.2	54	0.8
Sub. Res. Area C	10	0.1	10	0.1	28	0.3	12	0.1	12	0.1	30	0.4	12	0.1	12	0.1	52	0.7
Bhead Summer Feed. Area	n	0.0	n	0.0	48	0.6	n	0.0	n	0.0	73	1.3	n	0.0	n	0.0	73	1.3
Bhead Fall Feed. Area A	10	0.1	10	0.1	21	0.2	11	0.1	11	0.1	29	0.3	12	0.1	12	0.1	34	0.4
Bhead Fall Feed. Area B	3	0.0	3	0.0	9	0.1	3	0.0	3	0.0	9	0.1	3	0.0	3	0.0	48	0.7
Bhead Mig. Area A	3	0.0	3	0.0	26	0.3	4	0.0	4	0.0	29	0.3	5	0.1	5	0.1	31	0.4
Bhead Mig. Area B	7	0.1	7	0.1	16	0.2	8	0.1	8	0.1	18	0.2	8	0.1	8	0.1	26	0.3
Fall Bowhead Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	1	0.0	1	0.0	71	1.2
Gray Whale Area	3	0.0	2	0.0	5	0.1	4	0.0	3	0.0	6	0.1	4	0.0	4	0.0	9	0.1
Seabird Offshore Area	14	0.1	12	0.1	25	0.3	20	0.2	19	0.2	53	0.8	22	0.2	21	0.2	59	0.9
Lagoon Area 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Lagoon Area 2	5	0.1	5	0.1	11	0.1	8	0.1	7	0.1	18	0.2	8	0.1	8	0.1	21	0.2
Lagoon Area 3	7	0.1	7	0.1	63	1.0	8	0.1	8	0.1	64	1.0	9	0.1	9	0.1	65	1.0
Lagoon Area 4	2	0.0	2	0.0	4	0.0	3	0.0	3	0.0	7	0.1	3	0.0	3	0.0	8	0.1
Lagoon Area 5	2	0.0	2	0.0	5	0.1	2	0.0	2	0.0	6	0.1	2	0.0	2	0.0	6	0.1
Lagoon Area 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	10	0.1
Ice/Sea Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	2	0.0	2	0.0	4	0.0
Ice/Sea Segment 2	n	0.0	n	0.0	1	0.0	2	0.0	2	0.0	4	0.0	3	0.0	2	0.0	7	0.1
Ice/Sea Segment 3	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	4	0.0	8	0.1	8	0.1	36	0.4
Ice/Sea Segment 4	1	0.0	1	0.0	2	0.0	6	0.1	6	0.1	25	0.3	8	0.1	8	0.1	37	0.5
Ice/Sea Segment 5	4	0.0	4	0.0	25	0.3	8	0.1	8	0.1	44	0.6	9	0.1	9	0.1	46	0.6
Ice/Sea Segment 6	6	0.1	6	0.1	42	0.5	6	0.1	6	0.1	44	0.6	8	0.1	8	0.1	48	0.6
Ice/Sea Segment 7	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	5	0.0	2	0.0	2	0.0	7	0.1
Ice/Sea Segment 8	2	0.0	2	0.0	4	0.0	3	0.0	3	0.0	8	0.1	3	0.0	3	0.0	10	0.1
Ice/Sea Segment 9	2	0.0	2	0.0	4	0.0	3	0.0	3	0.0	7	0.1	3	0.0	3	0.0	15	0.2
Ice/Sea Segment 10	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	49	0.7
Ice/Sea Segment 11	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	65	1.0
Ice/Sea Segment 12	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	37	0.5	n	0.0	n	0.0	64	1.0
Ice/Sea Segment 13	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 14	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	9	0.1	n	0.0	n	0.0	9	0.1

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

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Table F-20.

Combined probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Barrow Deferral Alternative versus Chukchi Deferral Alternative versus Kaktovik Deferral Alternative. Probabilities are for spills 1,000 barrels or greater. Results are based on open-water trajectories only; for contacts within 3, 10, and 30 days of summer spills or melt out of overwintering spills.

Target	------- Within 3 days --------- DEFERRAL ALTERNATIVE						------- Within 10 days -------- DEFERRAL ALTERNATIVE						------- Within 30 days -------- DEFERRAL ALTERNATIVE					
	BARROW OPNWATER		CHUKCHI OPNWATER		KAKTOVIK OPNWATER		BARROW OPNWATER		CHUKCHI OPNWATER		KAKTOVIK OPNWATER		BARROW OPNWATER		CHUKCHI OPNWATER		KAKTOVIK OPNWATER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	8	0.1	8	0.1	5	0.1	20	0.2	20	0.2	15	0.2	23	0.3	23	0.3	18	0.2
Sub. Res. Area A	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Sub. Res. Area B	13	0.1	14	0.1	14	0.2	18	0.2	18	0.2	19	0.2	20	0.2	20	0.2	21	0.2
Sub. Res. Area C	10	0.1	10	0.1	5	0.1	12	0.1	12	0.1	5	0.1	12	0.1	12	0.1	5	0.1
Bhead Summer Feed. Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Bhead Fall Feed. Area A	10	0.1	10	0.1	10	0.1	11	0.1	11	0.1	11	0.1	12	0.1	12	0.1	12	0.1
Bhead Fall Feed. Area B	3	0.0	3	0.0	1	0.0	3	0.0	3	0.0	1	0.0	3	0.0	3	0.0	1	0.0
Bhead Mig. Area A	3	0.0	3	0.0	3	0.0	4	0.0	4	0.0	4	0.0	5	0.1	5	0.1	4	0.0
Bhead Mig. Area B	7	0.1	7	0.1	5	0.0	8	0.1	8	0.1	5	0.0	8	0.1	8	0.1	5	0.0
Fall Bowhead Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0
Gray Whale Area	2	0.0	2	0.0	3	0.0	3	0.0	3	0.0	4	0.0	4	0.0	4	0.0	4	0.0
Seabird Offshore Area	12	0.1	11	0.1	13	0.1	19	0.2	18	0.2	19	0.2	21	0.2	20	0.2	21	0.2
Lagoon Area 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Lagoon Area 2	5	0.1	5	0.1	5	0.1	7	0.1	8	0.1	8	0.1	8	0.1	8	0.1	8	0.1
Lagoon Area 3	7	0.1	7	0.1	6	0.1	8	0.1	8	0.1	7	0.1	9	0.1	9	0.1	7	0.1
Lagoon Area 4	2	0.0	2	0.0	1	0.0	3	0.0	3	0.0	1	0.0	3	0.0	3	0.0	1	0.0
Lagoon Area 5	2	0.0	2	0.0	n	0.0	2	0.0	2	0.0	n	0.0	2	0.0	2	0.0	n	0.0
Lagoon Area 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	2	0.0
Ice/Sea Segment 2	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	3	0.0
Ice/Sea Segment 3	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	2	0.0	8	0.1	8	0.1	8	0.1
Ice/Sea Segment 4	1	0.0	1	0.0	1	0.0	6	0.1	6	0.1	5	0.1	8	0.1	8	0.1	8	0.1
Ice/Sea Segment 5	4	0.0	4	0.0	4	0.0	8	0.1	8	0.1	8	0.1	9	0.1	9	0.1	8	0.1
Ice/Sea Segment 6	6	0.1	6	0.1	5	0.1	6	0.1	6	0.1	6	0.1	8	0.1	8	0.1	7	0.1
Ice/Sea Segment 7	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	2	0.0	2	0.0	2	0.0
Ice/Sea Segment 8	2	0.0	2	0.0	2	0.0	3	0.0	3	0.0	2	0.0	3	0.0	3	0.0	2	0.0
Ice/Sea Segment 9	2	0.0	2	0.0	1	0.0	3	0.0	3	0.0	1	0.0	3	0.0	3	0.0	1	0.0
Ice/Sea Segment 10	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Ice/Sea Segment 11	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Ice/Sea Segment 12	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 13	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 14	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

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Table F-21.

Combined probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, proposed lease offering versus Barrow Deferral Alternative versus the cumulative case (proposal plus existing, including Canadian oil). Probabilities are for spills 1,000 barrels and greater. Results are based on open-water trajectories only; for contacts within 3, 10, and 30 days of summer spills or melt out of overwintering spills. (Offshore spills in summer from the Lisburne Field are assumed to contact Land Segment 34.)

Land Segment	------- Within 3 days ---------						------- Within 10 days --------						------- Within 30 days --------					
	PROPOSAL OPNWATER CASE		ALTERNAT BARROW OPNWATER		CUMULATV OPNWATER CASE		PROPOSAL OPNWATER CASE		ALTERNAT BARROW OPNWATER		CUMULATV OPNWATER CASE		PROPOSAL OPNWATER CASE		ALTERNAT BARROW OPNWATER		CUMULATV OPNWATER CASE	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
19	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0
20	1	0.0	1	0.0	1	0.0	2	0.0	2	0.0	5	0.1	3	0.0	3	0.0	9	0.1
21	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	4	0.0	1	0.0	1	0.0	4	0.0
22	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	4	0.0	1	0.0	1	0.0	4	0.0
23	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	5	0.1	2	0.0	1	0.0	8	0.1
24	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	5	0.0
25	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0
26	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0
27	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	10	0.1	1	0.0	1	0.0	10	0.1
28	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	16	0.2	2	0.0	2	0.0	19	0.2
29	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	15	0.2	1	0.0	1	0.0	17	0.2
30	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	7	0.1	1	0.0	1	0.0	8	0.1
31	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
32	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	3	0.0	n	0.0	n	0.0	4	0.0
33	n	0.0	n	0.0	4	0.0	n	0.0	n	0.0	6	0.1	n	0.0	n	0.0	6	0.1
34	2	0.0	2	0.0	34	0.4	3	0.0	3	0.0	36	0.4	3	0.0	3	0.0	36	0.4
35	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	5	0.1	1	0.0	1	0.0	6	0.1
36	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	2	0.0
37	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0
38	1	0.0	1	0.0	2	0.0	2	0.0	2	0.0	5	0.0	2	0.0	2	0.0	5	0.1
39	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
41	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
42	1	0.0	1	0.0	3	0.0	1	0.0	1	0.0	4	0.0	1	0.0	1	0.0	4	0.0
48	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	9	0.1
75	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	9	0.1	n	0.0	n	0.0	9	0.1
76	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	17	0.2
77	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	17	0.2
78	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	31	0.4
79	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	17	0.2
81	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0
82	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	2	0.0	2	0.0	3	0.0
83	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	3	0.0
86	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	2	0.0
87	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	3	0.0	5	0.0	5	0.0	9	0.1
88	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	2	0.0	2	0.0	4	0.0
89	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	2	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table F-22.

Combined probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Barrow Deferral Alternative versus Chukchi Deferral Alternative versus Kaktovik Deferral Alternative. Probabilities are for spills 1,000 barrels or greater. Results are based on open-water trajectories only; for contacts within 3, 10, and 30 days of summer spills or melt out of overwintering spills.

Land Segment	------- Within 3 days ---------						------- Within 10 days --------						------- Within 30 days --------					
	DEFERRAL ALTERNATIVE						DEFERRAL ALTERNATIVE						DEFERRAL ALTERNATIVE					
	BARROW OPNWATER		CHUKCHI OPNWATER		KAKTOVIK OPNWATER		BARROW OPNWATER		CHUKCHI OPNWATER		KAKTOVIK OPNWATER		BARROW OPNWATER		CHUKCHI OPNWATER		KAKTOVIK OPNWATER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
19	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
20	1	0.0	1	0.0	1	0.0	2	0.0	2	0.0	2	0.0	3	0.0	3	0.0	3	0.0
21	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
22	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
23	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	2	0.0	1	0.0
24	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0
27	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
28	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	2	0.0
29	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
30	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	1	0.0
34	2	0.0	2	0.0	2	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
35	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
36	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0
37	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0
38	1	0.0	1	0.0	n	0.0	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	1	0.0
42	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0
81	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0
82	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	2	0.0	1	0.0	1	0.0
83	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
86	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0
87	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	5	0.0	3	0.0	4	0.0
88	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	1	0.0	2	0.0
89	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table F-23.

Combined Probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, proposed lease offering versus Barrow Deferral Alternative versus the cumulative case (proposal plus existing, including Canadian oil). Probabilities are for spills 100,000 barrels and greater. Results are based on winter trajectories only. (Offshore spills in winter from Lisburne Field in the cumulative case are assumed to contact land.)

Target	------- Within 3 days ---------						------- Within 10 days --------						-------- Entire winter --------					
	PROPOSAL WINTER CASE		ALTERNAT BARROW WINTER		CUMULATV WINTER CASE		PROPOSAL WINTER CASE		ALTERNAT BARROW WINTER		CUMULATV WINTER CASE		PROPOSAL WINTER CASE		ALTERNAT BARROW WINTER		CUMULATV WINTER CASE	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	1	0.0	1	0.0	5	0.0	1	0.0	1	0.0	9	0.1	1	0.0	1	0.0	12	0.1
Sub. Res. Area A	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sub. Res. Area A - Spring	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sub. Res. Area B	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	3	0.0	2	0.0	1	0.0	5	0.1
Sub. Res. Area B - Spring	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	3	0.0
Sub. Res. Area C	1	0.0	1	0.0	4	0.0	1	0.0	1	0.0	4	0.0	1	0.0	1	0.0	6	0.1
Gray Whale Area - October	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gray Whale Area - April	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Bhead Spring Mig. Cor. A	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0
Bhead Spring Mig. Cor. B	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	4	0.0	1	0.0	1	0.0	13	0.1
Bhead Mig. Area A - Oct.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Bhead Mig. Area B - Oct.	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Ice/Sea Seg. 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 1 - Spring	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 2 - Spring	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 3	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	3	0.0
Ice/Sea Seg. 3 - Spring	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Ice/Sea Seg. 4	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0
Ice/Sea Seg. 4 - Spring	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Ice/Sea Seg. 5	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	3	0.0	1	0.0	1	0.0	6	0.1
Ice/Sea Seg. 5 - Spring	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	4	0.0
Ice/Sea Seg. 6	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	2	0.0	1	0.0	1	0.0	2	0.0
Ice/Sea Seg. 7	n	0.0	n	0.0	2	0.0	1	0.0	1	0.0	3	0.0	1	0.0	1	0.0	3	0.0
Ice/Sea Seg. 8	1	0.0	1	0.0	3	0.0	1	0.0	1	0.0	4	0.0	1	0.0	1	0.0	4	0.0
Ice/Sea Seg. 9	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	2	0.0
Ice/Sea Seg. 10	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	10	0.1
Ice/Sea Seg. 11	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	11	0.1	n	0.0	n	0.0	11	0.1
Ice/Sea Seg. 12	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	13	0.1	n	0.0	n	0.0	13	0.1
Ice/Sea Seg. 13	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	7	0.1	n	0.0	n	0.0	7	0.1
Ice/Sea Seg. 14	n	0.0	n	0.0	5	0.1	n	0.0	n	0.0	5	0.1	n	0.0	n	0.0	5	0.1

Note: n = less than 0.5 percent; ** = greater than 99.5 percent; Spring = April 1 through June 15.

Table F-24

Combined Probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Barrow Deferral Alternative versus Chukchi Deferral Alternative versus Kaktovik Deferral Alternative. Probabilities are for spills 100,000 barrels or greater. Results are based on winter trajectories only.

Target	------- Within 3 days --------- DEFERRAL ALTERNATIVE						------- Within 10 days -------- DEFERRAL ALTERNATIVE						-------- Entire winter -------- DEFERRAL ALTERNATIVE					
	BARROW WINTER		CHUKCHI WINTER		KAKTOVIK WINTER		BARROW WINTER		CHUKCHI WINTER		KAKTOVIK WINTER		BARROW WINTER		CHUKCHI WINTER		KAKTOVIK WINTER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Sub. Res. Area A	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sub. Res. Area A - Spring	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sub. Res. Area B	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Sub. Res. Area B - Spring	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sub. Res. Area C	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Gray Whale Area - October	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gray Whale Area - April	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Bhead Spring Mig. Cor. A	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0	1	0.0
Bhead Spring Mig. Cor. B	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Bhead Mig. Area A - Oct.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Bhead Mig. Area B - Oct.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 1 - Spring	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 2 - Spring	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 3	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Ice/Sea Seg. 3 - Spring	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 4	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Ice/Sea Seg. 4 - Spring	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 5	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Ice/Sea Seg. 5 - Spring	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0
Ice/Sea Seg. 7	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0
Ice/Sea Seg. 8	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Ice/Sea Seg. 9	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	n	0.0
Ice/Sea Seg. 10	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 11	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 12	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 13	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Seg. 14	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent; Spring = April 1 through June 15.

Table F-25.

Combined Probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, proposed lease offering versus Barrow Deferral Alternative versus the *cumulative case (proposal plus existing, including Canadian oil)*. Probabilities are for spills 100,000 barrels and greater. Results are based on winter trajectories only. (Offshore spills in winter from Lisburne Field in the cumulative case are assumed to contact Land Segment 34.)

Land Segment	------- Within 3 days ---------						------- Within 10 days --------						-------- Entire winter --------					
	PROPOSAL WINTER CASE		ALTERNAT BARROW WINTER		CUMULATV WINTER CASE		PROPOSAL WINTER CASE		ALTERNAT BARROW WINTER		CUMULATV WINTER CASE		PROPOSAL WINTER CASE		ALTERNAT BARROW WINTER		CUMULATV WINTER CASE	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
20	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
23	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0
24	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0
27	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
28	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	2	0.0
29	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
33	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
34	n	0.0	n	0.0	3	0.0	n	0.0	n	0.0	3	0.0	n	0.0	n	0.0	3	0.0
35	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
73	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0
74	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	4	0.0
75	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	7	0.1
76	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	6	0.1
77	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	4	0.0
78	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	9	0.1
79	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	4	0.0
80	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0
81	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	4	0.0
82	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	2	0.0
83	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
87	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	2	0.0
88	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	2	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table F-26.

Combined Probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Barrow Deferral Alternative versus Chukchi Deferral Alternative versus Kaktovik Deferral Alternative. Probabilities are for spills 100,000 barrels or greater. Results are based on winter trajectories only.

Land Segment	------- Within 3 days ---------						------- Within 10 days --------						-------- Entire winter --------					
	DEFERRAL ALTERNATIVE						DEFERRAL ALTERNATIVE						DEFERRAL ALTERNATIVE					
	BARROW WINTER		CHUKCHI WINTER		KAKTOVIK WINTER		BARROW WINTER		CHUKCHI WINTER		KAKTOVIK WINTER		BARROW WINTER		CHUKCHI WINTER		KAKTOVIK WINTER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
79	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0
81	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0
82	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0
87	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	1	0.0
88	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	1	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table F-27.

Combined Probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, proposed lease offering versus Barrow Deferral Alternative versus the cumulative case (proposal plus existing, including Canadian oil). Probabilities are for spills 100,000 barrels and greater. Results are based on open-water trajectories only; for contacts within 3, 10, and 30 days of summer spills or melt out of overwintering spills. (Offshore spills in summer from Lisburne Field in the cumulative case are assumed to contact land.)

Target	------- Within 3 days ---------						------- Within 10 days --------						------- Within 30 days --------					
	PROPOSAL OPNWATER CASE		ALTERNAT BARROW OPNWATER		CUMULATV OPNWATER CASE		PROPOSAL OPNWATER CASE		ALTERNAT BARROW OPNWATER		CUMULATV OPNWATER CASE		PROPOSAL OPNWATER CASE		ALTERNAT BARROW OPNWATER		CUMULATV OPNWATER CASE	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	n	0.0	n	0.0	2	0.0	1	0.0	1	0.0	5	0.1	1	0.0	1	0.0	8	0.1
Sub. Res. Area A	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sub. Res. Area B	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	2	0.0	1	0.0	1	0.0	3	0.0
Sub. Res. Area C	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	3	0.0
Bhead Sum. Feed. Area	n	0.0	n	0.0	3	0.0	n	0.0	n	0.0	5	0.1	n	0.0	n	0.0	5	0.1
Bhead Fall Feed. Area A	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	2	0.0
Bhead Fall Feed. Area B	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0
Bhead Mig. Area A	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	2	0.0
Bhead Mig. Area B	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Fall Bowhead Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	5	0.0
Gray Whale Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Seabird Offshore Area	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	3	0.0	1	0.0	1	0.0	4	0.0
Lagoon Area 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Lagoon Area 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Lagoon Area 3	n	0.0	n	0.0	4	0.0	n	0.0	n	0.0	4	0.0	n	0.0	n	0.0	4	0.0
Lagoon Area 4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Lagoon Area 5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Lagoon Area 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0
Ice/Sea Segment 4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	2	0.0
Ice/Sea Segment 5	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	3	0.0
Ice/Sea Segment 6	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	3	0.0
Ice/Sea Segment 7	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 8	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Ice/Sea Segment 9	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
Ice/Sea Segment 10	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0
Ice/Sea Segment 11	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	4	0.0
Ice/Sea Segment 12	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	4	0.0
Ice/Sea Segment 13	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 14	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

Table F-28.

Combined Probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Barrow Deferral Alternative versus Chukchi Deferral Alternative versus Kaktovik Deferral Alternative. Probabilities are for spills 100,000 barrels or greater. Results are based on open-water trajectories only; for contacts within 3, 10, and 30 days of summer spills or melt out of overwintering spills.

Target	------- Within 3 days ---------						------- Within 10 days --------						------- Within 30 days --------					
	DEFERRAL ALTERNATIVE						DEFERRAL ALTERNATIVE						DEFERRAL ALTERNATIVE					
	BARROW OPNWATER		CHUKCHI OPNWATER		KAKTOVIK OPNWATER		BARROW OPNWATER		CHUKCHI OPNWATER		KAKTOVIK OPNWATER		BARROW OPNWATER		CHUKCHI OPNWATER		KAKTOVIK OPNWATER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Sub. Res. Area A	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sub. Res. Area B	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Sub. Res. Area C	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Bhead Sum. Feed. Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Bhead Fall Feed. Area A	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0
Bhead Fall Feed. Area B	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Bhead Mig. Area A	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Bhead Mig. Area B	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Fall Bowhead Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gray Whale Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Seabird Offshore Area	1	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Lagoon Area 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Lagoon Area 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Lagoon Area 3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Lagoon Area 4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Lagoon Area 5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Lagoon Area 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 7	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 8	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 9	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 10	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 11	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 12	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 13	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Ice/Sea Segment 14	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

Table F-29.

Combined Probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, proposed lease offering versus Barrow Deferral Alternative versus the cumulative case (proposal plus existing, including Canadian oil). Probabilities are for spills 100,000 barrels and greater. Results are based on open-water trajectories only; for contacts within 3, 10, and 30 days of summer spills or melt out of overwintering spills. (Offshore spills in summer from Lisburne Field in the cumulative case are assumed to contact Land Segment 34.)

Land Segment	------- Within 3 days ---------						------- Within 10 days --------						------- Within 30 days --------					
	PROPOSAL OPNWATER CASE		ALTERNAT BARROW OPNWATER		CUMULATV OPNWATER CASE		PROPOSAL OPNWATER CASE		ALTERNAT BARROW OPNWATER		CUMULATV OPNWATER CASE		PROPOSAL OPNWATER CASE		ALTERNAT BARROW OPNWATER		CUMULATV OPNWATER CASE	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
28	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
29	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
34	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	2	0.0
76	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
77	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
78	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
79	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
87	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table F-30.

Combined Probabilities (expressed as percent chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Barrow Deferral Alternative versus Chukchi Deferral Alternative versus Kaktovik Deferral Alternative. Probabilities are for spills 100,000 barrels or greater. Results are based on open-water trajectories only; for contacts within 3, 10, and 30 days of summer spills or melt out of overwintering spills.

Land Segment	------- Within 3 days ---------						------- Within 10 days --------						------- Within 30 days --------					
	DEFERRAL ALTERNATIVE						DEFERRAL ALTERNATIVE						DEFERRAL ALTERNATIVE					
	BARROW OPNWATER		CHUKCHI OPNWATER		KAKTOVIK OPNWATER		BARROW OPNWATER		CHUKCHI OPNWATER		KAKTOVIK OPNWATER		BARROW OPNWATER		CHUKCHI OPNWATER		KAKTOVIK OPNWATER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

APPENDIX G

EXPLORATION, DEVELOPMENT AND PRODUCTION, AND TRANSPORTATION ESTIMATES AND ASSUMPTIONS

G

Table G-1
Beaufort Sea Planning Area - Sale 97
Estimated Schedule of Exploration, Development, and Production for the Low-Case Resource Estimate[1]

SALE YEAR	CAL. YEAR	EXPLORATION WELLS	DELINEATION WELLS Oil	EXPLORATION/ DELINEATION DRILLING UNITS	PRODUCTION PLATFORMS AND EQUIPMENT Oil	PRODUCTION AND SERVICE Wells Oil	PRODUCTION AND SERVICE Rigs	TRUNK PIPELINES (kilometers) Oil	NUMBER OF SHORE BASES	PRODUCTION Oil MMbbls
1	1988									
2	1989									
3	1990		1	1						
4	1991		1	1						
5	1992									
6	1993									
7	1994				1	3	1			
8	1995					4	1		0	
9	1996								4	
10	1997								9	
11	1998								9	
12	1999								9	
13	2000								9	
14	2001								9	
15	2002								9	
16	2003								8	
17	2004								7	
18	2005								6	
19	2006								5	
20	2007								5	
21	2008								4	
22	2009								4	
23	2010								3	
24	2011								3	
25	2012								3	
26	2013								2	
27	2014								2	
28	2015									
29	2016									
30	2017									
31	2018									
32	2019									
33	2020									
Total		--	2		1	7			110	

Sources: USDOI, MMS, 1985a; USDOI, MMS, 1985c; and USDOI, MMS, 1987b.

1. This schedule is cumulative with previous lease sales (BF, 71, and 87) in the Beaufort Sea Planning Area. The schedule assumes no regulatory time delays. Production of natural gas is not considered to be economic until some time in the future.
2. Yearly drilling unit and rig numbers depend on the number of operators. They are not additive.
3. The year marked with an asterisk represents an expenditure to upgrade an existing exploration shore base.

Table G-2
Beaufort Sea Planning Area - Sale 97
Estimated Schedule of Exploration, Development, and Production for the Mean-Case Resource Estimate[1]

SALE YEAR	CAL. YEAR	EXPLORATION WELLS	DELINEATION WELLS Oil	EXPLORATION/ DELINEATION DRILLING UNITS[2]	PRODUCTION PLATFORMS AND EQUIPMENT Oil	PRODUCTION AND SERVICE[2] Wells Oil	PRODUCTION AND SERVICE[2] Rigs	TRUNK PIPELINES[4] (kilometers) Oil	NUMBER OF SHORE BASES[3]	PRODUCTION Oil MMbbls
1	1988									
2	1989	2		2						
3	1990	2	1	2						
4	1991	2	1	2						
5	1992	2	1	2						
6	1993	2	1	2						
7	1994	1		1						
8	1995									
9	1996									
10	1997									
11	1998				2	12	4	160		
12	1999					27	4	160		0
13	2000									14
14	2001									55
15	2002									55
16	2003									55
17	2004									55
18	2005									55
19	2006									55
20	2007									48
21	2008									42
22	2009									37
23	2010									31
24	2011									27
25	2012									23
26	2013									21
27	2014									19
28	2015									17
29	2016									15
30	2017									14
31	2018									12
32	2019									
33	2020									
Total		11	4		2	39		320	*	650

Sources: USDOI, MMS, 1985a; USDOI, MMS, 1985c; and USDOI, MMS, 1987b.

1. This schedule is cumulative with previous lease sales (BF, 71, and 87) in the Beaufort Sea Planning Area. The schedule assumes no regulatory time delays. Production of natural gas is not considered to be economic until some time in the future.
2. Yearly drilling unit and rig numbers depend on the number of operators. They are not additive.
3. The year marked with an asterisk represents an expenditure to upgrade an existing exploration shore base.
4. One-half of the total pipeline length is assumed to be offshore and the other half onshore.

Table G-3
Beaufort Sea Planning Area - Sale 97
Estimated Schedule of Exploration, Development, and Production
for the High-Case Resource Estimate[1]

SALE YEAR	CAL. YEAR	EXPLORATION WELLS	DELINEATION WELLS Oil	EXPLORATION/ DELINEATION DRILLING UNITS[2]	PRODUCTION PLATFORMS AND EQUIPMENT Oil	PRODUCTION AND SERVICE Wells Oil	PRODUCTION AND SERVICE Rigs[2]	TRUNK PIPELINES (kilometers)[4] Oil	NUMBER OF SHORE BASES[3]	PRODUCTION Oil MMbbls
1	1988									
2	1989	5		3					*	
3	1990	5	3	4						
4	1991	5	3	5						
5	1992	5	3	5						
6	1993	4	2	4						
7	1994	2	1	2						
8	1995									
9	1996									
10	1997							160	*	
11	1998				3	24	6	160		
12	1999				3	77	12	160		0
13	2000									43
14	2001									139
15	2002									139
16	2003									139
17	2004									139
18	2005									139
19	2006									139
20	2007									123
21	2008									108
22	2009									95
23	2010									80
24	2011									68
25	2012									60
26	2013									53
27	2014									48
28	2015									43
29	2016									38
30	2017									35
31	2018									32
32	2019									
33	2020									
Total		26	12		6	101		480	*	1660

Sources: USDOI, MMS, 1985a; USDOI, MMS, 1985c; and USDOI, MMS, 1987b.

1. This schedule is cumulative with previous lease sales (BF, 71, and 87) in the Beaufort Sea Planning Area. The schedule assumes no regulatory time delays. Production of natural gas is not considered to be economic until some time in the future.
2. Yearly drilling unit and rig numbers depend on the number of operators. They are not additive.
3. The year marked with an asterisk represents an expenditure to upgrade an existing exploration shore base.
4. One-half of the total pipeline length is assumed to be offshore and the other half onshore.

Table G-4
Beaufort Sea Planning Area (Leased Tracts)
Estimated Schedule of Exploration, Development, and Production
for the Mean-Case Resource Estimate

SALE YEAR	CAL. YEAR	EXPLORATION WELLS	DELINEATION WELLS Oil	EXPLORATION/ DELINEATION DRILLING UNITS	PRODUCTION PLATFORMS AND EQUIPMENT Oil	PRODUCTION AND SERVICE Wells Oil	PRODUCTION AND SERVICE Rigs	TRUNK PIPELINES (kilometers) Oil	NUMBER OF SHORE BASES	PRODUCTION Oil MMbbls
1	1984								*	
2	1985	6		3						
3	1986	6	1	4						
4	1987	6	1	4						
5	1988	5	1	3						
6	1989	5	1	3						
7	1990	2	1	2				80		
8	1991							160		
9	1992				2	6	1	160		0
10	1993					30	3			17
11	1994									50
12	1995									50
13	1996									50
14	1997									50
15	1998									50
16	1999									50
17	2000									44
18	2001									39
19	2002									34
20	2003									29
21	2004									25
22	2005									22
23	2006									19
24	2007									17
25	2008									16
26	2009									14
27	2010									13
28	2011									11
29	2012									0
30	2013									
31	2014									
32	2015									
33	2016									
34	2017									
35	2018									
36	2019									
37	2020									
Total		30	5		2	36		400	*	600

Sources: USDOI, MMS, 1985a, and USDOI, MMS, 1985c.

1. This schedule is cumulative with previous lease sales (BF, 71, and 87) in the Beaufort Sea Planning Area. The schedule assumes no regulatory time delays. Production of natural gas is not considered to be economic until some time in the future.
2. Yearly drilling unit and rig numbers depend on the number of operators. They are not additive.
3. The year marked with an asterisk represents an expenditure to upgrade an existing exploration shore base.
4. One-half of the total pipeline length is assumed to be offshore and the other half onshore.

Table G-5
Beaufort Sea Planning Area - Sale 97
Estimated Schedule of Exploration, Development, and Production
for the Mean-Case Resource
for Alternative IV-Barrow Deferral Alternative[1]

SALE YEAR	CAL. YEAR	EXPLORATION WELLS	DELINEATION WELLS Oil	EXPLORATION/ DELINEATION DRILLING UNITS[2]	PRODUCTION PLATFORMS AND EQUIPMENT Oil	PRODUCTION AND SERVICE Wells Oil	PRODUCTION AND SERVICE Rigs[2]	TRUNK PIPELINES (kilometers)[4] Oil	NUMBER OF SHORE BASES[3]	PRODUCTION Oil MMbbls
1	1988									
2	1989	2		2						
3	1990	2	1	2						
4	1991	2	1	2						
5	1992	2	1	2						
6	1993	2	1	2						
7	1994	1		1						
8	1995									
9	1996									
10	1997									
11	1998				2	12	4	160		
12	1999					26	4	160		0
13	2000									16
14	2001									53
15	2002									53
16	2003									53
17	2004									53
18	2005									53
19	2006									53
20	2007									47
21	2008									41
22	2009									36
23	2010									30
24	2011									26
25	2012									23
26	2013									20
27	2014									18
28	2015									16
29	2016									14
30	2017									13
31	2018									12
32	2019									
33	2020									
Total		11	4		2	38		320		630

Sources: USDOI, MMS, 1985a; USDOI, MMS, 1985c; and USDOI, MMS, 1987b.

1. This schedule is cumulative with previous lease sales (BF, 71, and 87) in the Beaufort Sea Planning Area. The schedule assumes no regulatory time delays. Production of natural gas is not considered to be economic until some time in the future.
2. Yearly drilling unit and rig numbers depend on the number of operators. They are not additive.
3. The year marked with an asterisk represents an expenditure to upgrade an existing exploration shore base.
4. One-half of the total pipeline length is assumed to be offshore and the other half onshore.

Table G-6
Beaufort Sea Planning Area - Sale 97
Estimated Schedule of Exploration, Development, and Production
for the Mean-Case Resource Estimate
for Alternative VI-Kaktovik Deferral Alternative[1]

SALE YEAR	CAL. YEAR	EXPLORATION WELLS	DELINEATION WELLS Oil	EXPLORATION/ DELINEATION DRILLING UNITS[2]	PRODUCTION PLATFORMS AND EQUIPMENT Oil	PRODUCTION AND SERVICE Wells Oil	PRODUCTION AND SERVICE Rigs[2]	TRUNK PIPELINES (kilometers)[4] Oil	NUMBER OF SHORE BASES[3]	PRODUCTION Oil MMbbls
1	1988									
2	1989	2		2						
3	1990	2	1	2						
4	1991	2	1	2						
5	1992	2	1	2						
6	1993	2	1	2						
7	1994	1		1						
8	1995									
9	1996									
10	1997									
11	1998				2	12	4	160		
12	1999					22	4	160		0
13	2000									14
14	2001									47
15	2002									47
16	2003									47
17	2004									47
18	2005									47
19	2006									47
20	2007									41
21	2008									36
22	2009									32
23	2010									27
24	2011									23
25	2012									20
26	2013									18
27	2014									16
28	2015									15
29	2016									13
30	2017									12
31	2018									11
32	2019									
33	2020									
Total		11	4		2	34		320		560

Sources: USDOI, MMS, 1985a; USDOI, MMS, 1985c; and USDOI, MMS, 1987b.

1. This schedule is cumulative with previous lease sales (BF, 71, and 87) in the Beaufort Sea Planning Area. The schedule assumes no regulatory time delays. Production of natural gas is not considered to be economic until some time in the future.
2. Yearly drilling unit and rig numbers depend on the number of operators. They are not additive.
3. The year marked with an asterisk represents an expenditure to upgrade an existing exploration shore base.
4. One-half of the total pipeline length is assumed to be offshore and the other half onshore.

Table G-7
Beaufort Sea Planning Area - Sale 97
Estimated Schedule of Exploration, Development, and Production
for the Mean-Case Resource Estimate
for Alternative VI-Chukchi Deferral Alternative1/

SALE YEAR	CAL. YEAR	EXPLORATION WELLS	DELINEATION WELLS Oil	EXPLORATION/ DELINEATION DRILLING UNITS 2/	PRODUCTION PLATFORMS AND EQUIPMENT Oil	PRODUCTION AND SERVICE Wells Oil	PRODUCTION AND SERVICE Rigs 2/	TRUNK PIPELINES (kilometers) 4/ Oil	NUMBER OF SHORE BASES 3/	PRODUCTION Oil MMbbls
1	1988									
2	1989	2		2						
3	1990	2	1	2						
4	1991	2	1	2						
5	1992	2	1	2						
6	1993	2	1	2						
7	1994	1		1						
8	1995									
9	1996									
10	1997									
11	1998				2	12	4	160		
12	1999					26	4	160		0
13	2000									16
14	2001									53
15	2002									52
16	2003									52
17	2004									52
18	2005									52
19	2006									52
20	2007									46
21	2008									40
22	2009									35
23	2010									30
24	2011									25
25	2012									22
26	2013									20
27	2014									18
28	2015									16
29	2016									14
30	2017									13
31	2018									12
32	2019									
33	2020									
Total		11	4		2	38		320		620

Sources: USDOI, MMS, 1985a; USDOI, MMS, 1985c; and USDOI, MMS, 1987b.

1. This schedule is cumulative with previous lease sales (BF, 71, and 87) in the Beaufort Sea Planning Area. The schedule assumes no regulatory time delays. Production of natural gas is not considered to be economic until some time in the future.
2. Yearly drilling unit and rig numbers depend on the number of operators. They are not additive.
3. The year marked with an asterisk represents an expenditure to upgrade an existing exploration shore base.
4. One-half of the total pipeline length is assumed to be offshore and the other half onshore.

Table G-8
Summary of Previous Federal OCS Lease Sales in the Beaufort Sea Planning Area

Sale Number/Sale Name1/		Number of Blocks or Bidding Units: Offered	Leased	Area: Offered (Hectares)	Leased (Hectares)	Resource Estimates Mean Case, Proposal: Oil (MMbbls)	Gas (Tcf)
BF/Beaufort Sea 2/	Dec 1979					750	1,625
Federal		23	4	35,273	34,713 3/		
Federally Managed-Disputed		23	20	34,910			
State of Alaska		67	62	130,787	115,618 4/		
State Managed-Disputed		4	0	7,125			
71/Diapir Field	Oct 1982	338	121	738,879.16	268,256	2,380	1,780
87/Diapir Field Lease Offering	Aug 1984	1,419	227	3,145,870.83	497,971 5/	3,000	7,750
BF/71/87 (Revised)						600 6/	
97/Beaufort Sea	Jan 1988					650	7/

1/ Sale numbers will be used throughout this report.
2/ Those tracts within the BF lease area where there are conflicting and unresolved jurisdictional claims of the Federal and State governments have been designated as disputed tracts.
3/ Total area leased from Federal and Federally Managed-Disputed Tracts.
4/ Total area leased from State of Alaska and State Managed-Disputed Tracts.
5/ Includes 9,216 hectares for four blocks affected by a Canadian Claim of Jurisdiction.
6/ Revised resource estimate for all tracts leased in Sales BF, 71, and 87.
7/ Natural gas production in the Beaufort Sea currently is considered uneconomic.

Source: USDOI, MMS, 1985b.

Table G-9
Summary of Beaufort Sea Wells and Drilling Units

Type of Drilling Unit 1/	Number of Wells Drilled			
	State Leases	Federally Managed Disputed Tracts Sale BF 2/	Federal Tracts Sale 71	Federal Tracts Sale 87
Barrier and Natural Islands (14)	22	--	--	--
Artificial Islands--Water Depths 1-15 Meters				
Constructed in State Waters (12)	19	2 3/	--	--
Constructed in Federal Waters (4)	--	5	3	--
Ice Islands	1	--	--	--
Flood (1)	--	--	--	--
Spray (1)	--	--	1	--
Bottom-Founded Mobile Drilling Units	--	--		--
Concrete Island Drilling System (CIDS) (1)	--	--	2	1
Single-Steel Drilling Caison (SSDC) (1)	--	--	1	--
Ice-Strengthened Drillship (1)	--	--	--	3

1/ The number of drilling units used is shown in parentheses.
2/ The wells already drilled were not included in the estimate of future exploration and delineation wells shown in Table 3.
3/ Two wells were drilled from Seal Island--an artificial island constructed in State waters.

Table G-10
Summary Characteristics of Proposed Artificial Islands

Water Depth	15 m
Island Dimensions	
Surface Diameter	122 m
Freeboard	6 m
Side Slope	1:3
Base Diameter	248 m
Base Area	48,300 m^2
Volume (Calculated)	586,300 m^3
Volume of Material 1/	645,800 m^3

1/ Assumes 10 percent of the material will be lost due to compaction and settlement.

Table G-11
Site-Clearance Seismic-Survey Requirements and Assumptions

Survey Types[1/]	
Site-Specific Survey	
Approximate Grid Area	23 square kilometers[2/]
Approximate Length of Seismic Grid Lines	64.2 kilometers
Block-Wide Survey	
Approximate Grid Area	92 square kilometers
Approximate Length of Seismic Grid Lines	304.2 kilometers
Prospect-Wide Survey[3/]	
Approximate Grid Area	variable
Approximate Length of Seismic Grid Lines	variable
Survey Assumptions - Exploration[4/]	
Previous Sale Areas	
Number of Site-Specific Surveys	35
Sale 97 Area	
Number of Site-Specific Surveys	15
Survey Assumptions - Production[5/]	
Previous Sale Areas	
Number of Block-Wide Surveys	2
Sale 97 Area	
Number of Block-Wide Surveys	2
Estimated Survey Time	
Site-Specific Survey	2 days
Block-Wide Survey	7 days

Source: MMS, Alaska OCS Region.

1/ The type of survey conducted is subject to approval by the Regional Supervisor, Field Operations, MMS.
2/ An area that is about equal to one full OCS lease block.
3/ The area and length of the seismic lines depend on the size and shape of each prospect.
4/ Based on the number of exploration/delineation wells.
5/ Based on the number of production platforms.

Table G-12
Assumptions Used to Determine the Seafloor Area
Disturbed by Pipeline Trenching

Water Depth Ranges	Origin of Offshore Pipelines			
	Previous Sale Areas Production Platform Locations		Sale 97 Area Production Platform Locations	
	40 Meters Water Depth Eastern Beaufort Sea[3/]	20 Meters Water Depth Western Beaufort Sea[3/]	30 Meters Water Depth North of Oliktok Pt.[3/]	40 Meters Water Depth Chukchi Sea
0-10 Meters[1/]				
Mid-Water Depth (m)	5	5	5	5
Mid-Water Trenching Depth (m)[2/]	2	2	2	2
Length of Pipeline Segment (km)	33	35	13	5
Trenching Area Disturbed (hectares)	66	70	26	10
10-20 Meters[1/]				
Mid-Water Depth (m)	15	15	15	15
Mid-Water Trenching Depth (m)[2/]	3	3	3	3
Length of Pipeline Segment	32	35	13	10
Trenching Area Disturbed (hectares)	96	105	39	30
20-30 Meters[1/]				
Mid-Water Depth (m)	25		25	25
Mid-Water Trenching Depth (m)[2/]	5		5	5
Length of Pipeline Segment (km)	33		14	15
Trenching Area Disturbed (hectares)	165		70	75
30-40 Meters[1/]				
Mid-Water Depth (m)	35			35
Mid-Water Trenching Depth (m)[2/]	6			6
Length of Pipeline Segment (km)	32			90
Trenching Area Disturbed (hectares)	192			540
Totals				
Pipeline Length (km)[4/]	130	70	40	120
Area Disturbed[5/]				
Trenching (hectares)	519	175	135	655
Dumping (hectares)	1,038	350	270	1,310
Total (hectares)	1,557	525	405	1,965

1/ Pipeline routes form the production platforms to the shore are divided into 10-meter water-depth segments.
2/ (a) Trenching depths are only estimates. The actual trenching depth for each pipeline will depend upon a number of factors which include water depth, average gouge depth, average gouging rate, pipeline length for each water depth interval, and expected operational life of the pipeline.
(b) Trenching depth is assumed to be of the mid-water depth for each 10-meter water-depth segment.
(c) Trenching depths are based on data in Han-Padron (1985).
(d) Side slopes of the trench are assumed to be 1:5.
3/ Each pipeline is assumed to be divided into an equal number of length segments based upon the number of 10-meter water segments between the platform and the shore.
4/ Pipeline lengths are from Tables 2 and 3 of the report text.
5/ The seafloor area disturbed by dumping the material from the trench is assumed to be twice the area disturbed by the trenching.

APPENDIX H

ARCHAEOLOGICAL ANALYSIS PREPARED BY THE MMS AND SUPPORTING TABLES FOR SECTIONS III.D.3 AND IV.B.12

H

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
RESTON, VA. 22091

In Reply Refer To:
LMS-Mail Stop 644

APR 2 1985

RECEIVED
APR 9 1985
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Memorandum

To: Regional Director, Alaska Region

From: Deputy Associate Director for Offshore Leasing

Subject: Archaeological Analysis for Lease Sale No. 97, Diapir Field

In accordance with our 1982 agreement on assisting your office on archaeological analyses, we are providing recommendations on proposed Lease Sale No. 97.

Upon examination of the planning area maps for upcoming Lease Sale No. 97 and those for Lease Sale No. 87, we note that the entire area of the former is included in the latter. Therefore, the results of the Archaeological Analysis for Lease Sale No. 87 (Attachment 1) apply totally to Lease Sale No. 97.

The analysis for Lease Sale No. 87 prepared by Ed Friedman and Herb Schneider, headquarters archaeologist and geophysicist, respectively, concluded that the probability of a paleo-Indian site surviving intact in an arctic environment of ice gouging, thermokarst collapse, and thermal erosion is nonexistent. The findings of the analysis were that no blocks in the sale area should require a cultural resource survey report. The requirement for Lease Sale No. 97 should be the same.

In addition, we examined our files for new data that might alter our earlier assessment for cultural resource potential in the sale area; none were found. We requested that your office also conduct a files search (Attachment 2). In response to our request, we received the volume "Geologic Processes and Hazards of the Beaufort and Chukchi Sea Shelf and Coastal Regions" by P. Barnes, et al. We have reviewed the document and find additional information to support the findings for Lease Sale No. 87.

If you have any questions, please call Ed Friedman at FTS 928-6461.

Carolita Kallaur

Carolita Kallaur

2 Attachments

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
RESTON, VA. 22091

In Reply Refer To:
MMS-Mail Stop 644

JAN 24 1983

Memorandum

To: Regional Manager, Alaska OCS Region

From: Associate Director for Offshore Minerals Management

Subject: Archeological Analysis for the Proposed Outer Continental Shelf Lease Sale No. 87 (Diapir Field)

In accordance with our Interim Guidance on Outer Continental Shelf (OCS) Cultural Resources (May 14, 1982), we are submitting an archeological analysis for Lease Sale No. 87 (attached). The report discusses the potential for and the survivability and detectability of prehistoric cultural resources in the sale area. The analysis concludes that the probability of a paleo-Indian site surviving intact in an Arctic environment of ice gouging, thermokarst collapse, and thermal erosion is nonexistent. Therefore, the report finds no blocks in the sale area which exhibit a high probability that a prehistoric site exists and would require a cultural resource survey report. This summary report was prepared by Ed Friedman, Archeologist, and Herb Schneider, Geophysicist.

Because the Alaska OCS Region does not have archeological expertise on its staff, the Offshore Environmental Assessment Division offered to assist in preparing archeological analyses for Alaska OCS lease sales until such time that the Region is able to prepare its own analyses. The Interim Guidance also discusses this assistance. Please let us know if this arrangement remains appropriate.

Please review the analysis and use it with other information available to you in making your decisions concerning prehistoric cultural resource survey report requirements for the sale and later permitting actions. Please forward to us any comments you have regarding this analysis. If you have any questions or immediate concerns with this analysis, please contact Ed Friedman (FTS 928-7531) or Herb Schneider (FTS 928-6461).

Robert L. Rioux

Robert L. Rioux

Attachment

RECEIVED

JAN 31 1983

Minerals Manager, Alaska OCS Region
Minerals Management Service
Anchorage, Alaska

Archeological Analysis
Proposed Lease Sale No. 87
Beaufort and Northeast Chukchi Seas
Offshore Area

prepared by
Minerals Management Service
Offshore Environmental Assessment Division

Purpose

In accordance with the Minerals Management Service (MMS) Interim Guidance for Outer Continental Shelf (OCS) Cultural Resources (May 14, 1982), the Offshore Environmental Assessment Division (OEAD) has prepared the following archeological analysis for proposed OCS Lease Sale No. 87 off the Beaufort and Northeast Chukchi Seas of Alaska (sale area). The analysis is intended to aid the Alaska OCS Region in preparing environmental impact statement (EIS) discussions and the Leasing Division in making recommendations to the Secretary on cultural resource lease stipulations.

This archeological analysis assesses, on a block-specific basis, the distribution and survival potential of prehistoric sites in the proposed sale area.

Information Reviewed

To assess the potential for prehistoric sites in the sale area, OEAD has reviewed the following sources which are relevant in evaluating cultural resource potentials:

1. "Ice gouging characteristics: Their changing patterns from 1975-1977, Beaufort Sea, Alaska" (Barnes et al., 1978)--This report presents a detailed description and analysis of ice-gouge characteristics, defines terms, and describes causes and effects.

2. "Sedimentary processes on Arctic Shelves off the northern coast of Alaska" (Barnes and Reimnitz, 1974)--This report presents a description and analysis of sedimentary processes operating in the Arctic.

3. "Ice gouge obliteration and sediment redistribution event--1977-1978, Beaufort Sea, Alaska" (Barnes and Reimnitz, 1979)--This report presents a discussion of changes in shelf morphology observed during a resurvey of part of the inner shelf region of the central Beaufort Sea. Side scan sonar and bathymetric records are analyzed.

4. "Miscellaneous hydrologic and geologic observations on the inner Beaufort Sea Shelf, Alaska" (Barnes et al., 1977)--This report includes several preliminary studies of Arctic shelf processes, in the Alaskan Beaufort Sea, such as on coastal oceanography, current meter data, suspended matter, flow patterns, ice gouging, and barrier island morphology.

5. "Beaufort Sea cultural resource study: final report" (Dixon et al., 1978)--This report is a baseline study and analysis of the geologic,

2

bathymetric, and paleoecological conditions which influenced human habitation on the shelf of the Beaufort Sea during the late Pleistocene.

6. "Geologic framework, hydrocarbon potential and environmental conditions for exploration and development of proposed oil and gas Lease Sale No. 87 in the Beaufort and Northeast Chukchi Seas" (Grantz et al., 1982)--This report summarizes the regional and environmental geology and the potential mineral resources of the Diapir Field area. Specifically, it addresses the location and description of the area proposed for Lease Sale No. 87.

7. "Ice-Gouge data, Beaufort Sea, Alaska" (Rearic et al., 1981)--This report summarizes the ice-gouge data collected in the Beaufort Sea during the period 1972-1978 and presents methods used for data analysis.

8. "Sea ice as a geologic agent on the Beaufort Sea shelf of Alaska" (Reimnitz and Barnes, 1975)--This report presents a description and analysis of the geologic changes that sea ice has caused on the Beaufort Sea shelf with an emphasis on the affected sediments.

9. "Arctic continental shelf morphology related to sea-ice zonation, Beaufort Sea, Alaska" (Reimnitz et al., 1978)--This report is a study of sea-ice zonation and dynamics and their relationship to the bottom morphology and geology on the Beaufort Sea shelf. Landsat-1 and National Oceanic and Atmospheric Administration satellite imagery and a variety of ice and sea-floor data were used in the analysis.

Project Area Description

The area of the proposed lease sale (Figure 1) extends laterally more than 800 km from the continental shelf boundary between Canada and the United States in the east to 162°00'W. longitude in the west. Its north-south extent, from the three geographical mile limit off the northern Alaska coast (but 71°00'N. latitude in the Chukchi Sea) to 73°00'N. latitude, ranges from about 175 km at Point Barrow to about 370 km near Demarcation Bay. Lease Sale No. 87 offers for lease slightly more than 200,000 square km of the Beaufort and Chukchi Seas and adjacent Arctic Ocean (Grantz et al., 1982).

The proposed sale area contains approximately 8,600 blocks. About 125 of these have been leased, or tentatively leased, in Lease Sales BF and No. 71. Thus, about 8,475 blocks were considered in this archeological analysis for Lease Sale No. 87.

Method

The methods used to develop the archeological analysis were established in the MMS Interim Guidance of May 14, 1982.

The procedures outlined in the interim guidance are:

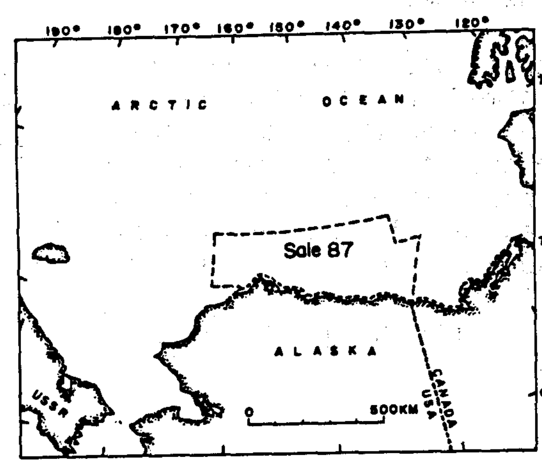

Figure 1. Proposed Lease Sale No. 87, Beaufort and Northeast Chukchi Seas Offshore Area.

1. Examine the appropriate regional baseline study to determine if the blocks within the sale area have a high, medium, or low probability for prehistoric sites--those tracts falling in the low category will receive no further archeological consideration. If all blocks are low probability, the cultural resource stipulation, if any, should not include a requirement for a survey report for the purpose of identifying prehistoric sites.

2. Examine the regional sea level curves when tracts of medium or high probability occur in the lease sale area. Blocks which lie in medium or high probability areas but were not above sea level during times of potential human habitation should be excluded from further consideration to incorporate a prehistoric site survey report requirement.

3. Examine the geological/geophysical literature for information regarding forces or processes that might have destroyed potential prehistoric sites or rendered them unrecoverable. Examples of such forces and processes are: glacial souring, ice gouging, erosion, and excessive sedimentation.

   Each block exhibiting exposure to such processes should be excluded from prehistoric site survey report consideration.

4. Examine the geology (resource) report, appropriate hazards survey, etc., for indications of significant landforms which were identified in the baseline study as being potentially habitable. Those blocks that do not contain significant landforms should be excluded from further consideration of a prehistoric site survey report requirement under a lease stipulation. Specific landforms on blocks that have not been excluded in steps 1 through 3 above and have a medium or high probability for prehistoric sites should be examined in detail. Those blocks that are not excluded from further consideration should require a site survey report under a lease stipulation. In instances in which an archeological analysis has been conducted up to step 4 and it has been determined that no data exist relating to landforms, those blocks that are subsequently leased must have their postlease geohazards survey data examined for prehistoric site potential by an MMS archeologist and geophysicist.

5. If steps 1 through 4 above do not exclude all of the blocks with prehistoric site potential that are offered for lease in a sale area, and if the lessee proposes to conduct activities on a landform on one of those blocks, a prehistoric site survey report is required pursuant to the controlling lease stipulation.

Analysis

Step 1--Review of Baseline Study

Using the above method, OEAD has reviewed the approximately 8,475 blocks included in the sale area. The Dixon et al., (1978) report indicates areas of high and medium probability occurring in three isolated areas along the Arctic coast; (1) immediately north of Jones and Return Islands, (2) east of Flaxman Island, and (3) northwest of Barter Island. Additionally, there is a continuous band of medium probability blocks from the Colville River west to Barrow. Within the latter area, 40 blocks are designated as high probability; these are located between Barrow on the west and Dease Inlet on the east. Table 1 lists the blocks corresponding to these probabilities. Probability areas are directly related to the identification of significant landforms on the OCS.

Table 1. Blocks within Lease Sale No. 87 area with medium or high probability for prehistoric sites.

	Map No.	Medium	Map No.	High
Area 1	NR5-4	14-18, 60-62		None
	NR6-3	291, 334-336, 375, 423, 424, 469-471 and 515		
Area 2	NR6-4	802-804, 847-849, 857, 858, and 893		None
Area 3	NR6-4	718, 771, 772, 813-815, 857, and 893		None
Area 4	NR4-2	507, 549-551, 675, 676, 719, and 763	NR4-2	418, 419, 461-463, 503-506, 545-548, 587-590, and 631-633
	NR5-1	425-428, 466-472, 506-512, 514-516, 559-561, 603-605 647-649, 652, 692-697, 738-742, 745-748, and 786-792	NR5-1	335-339, 378-383, 420-424, and 462-465
	NR5-2	749-754, 793-809, 839-853, 883-897, and 984, 986		

The criteria used for designating probability zones in the Dixon et al., (1978) report are:

1. Areas of High Probability

   a. Nonglacial river mouths and constricted marine approaches to these river mouths. Such areas would have concentrated anadromous fish and their predators.

   b. Natural terrestrial features, such as passes, which funnel movements of large mammals.

2. Areas of Medium Probability

North- and south-facing slopes. It has been noted that south-facing slopes tend to concentrate grazing mammals during early spring plant maturation and that many times north-facing slopes provide wind-blown snow free winter range. However, neither feature concentrates grazers into specific locations where large aggregates of animals can be harvested. Although these areas are generally more productive, the mammals are scattered over a comparatively large area.

Step 2--Review of sea level curves to determine habitability

The second step is to examine the regional sea level curves. Dixon et al., (1978) states that -125 meters was the maximum sea level recession during the late Wisconsin. Superimposing that depth against graphic No. 9 of Lease Sale No. 71 (which depicts all of Lease Sale No. 87 but with 50-meter contour intervals), it is apparent that only two blocks noted in Table 1, Nos. 335 and 418, are entirely beyond -150 meters and would not have been available for occupation. Regardless of other data sources, these two blocks should be deleted from potential cultural resource consideration. Developing an alternate sea level curve, Hopkins (1973) states that ". . . the shoreline probably lay between the -90 and -100 m isobaths during the maximum late Wisconsinan regression." Using these data, Blocks Nos. 335, 336, 337, 378, 379, 418, 419, 420, 421, 461, and 462 would not have been emergent. As there is no means available at present for the resolution of this apparent disagreement, it is prudent to use the Dixon et al., (1978) figure, allowing that Blocks Nos. 335 and 418 should be eliminated from further consideration. Information presented in step 3 and Appendix I will render this question moot.

Step 3--Review of geological/geophysical data to determine survivability

Step 3 is to use ". . . information regarding forces or processes that might have destroyed potential prehistoric sites or rendered them unrecoverable." Dixon et al., (1978) focused on the probability of paleo-Indian populations inhabiting the area of the OCS before the postglacial marine transgression. They also identified topographic features that these prehistoric groups would have sought to occupy and, in a general way, identified such features within the Beaufort Sea area. We do not dispute the idea that this area of the OCS may have been inhabited by paleo-Indian groups or that they selected specific topographic features for occupation. We point out that (a) the sites, if any, did not survive the transgression, (b) the topographic features that were occupied are no longer recognizable, and (c) these features are not detectable.

According to numerous researchers (Barnes et al., 1977; Hopkins and Hartz, 1978; and Lewellen, 1977) the probability for a paleo-Indian site surviving intact in this particular environment is extremely low owing to the combined processes of (a) thermokarst collapse and (b) thermal erosion accompanied by (c) lateral current-transport of resulting fine materials.

An additional factor working against the survival of prehistoric sites on the OCS is the process of ice gouging. Barnes and Reimnitz (1979) described in detail the extensive disturbance of the sea floor as a result of this phenomenon. Based on 3 years of research, they concluded that 2 percent of the bottom is randomly impacted by ice from one year to the next. These studies also show the changing character of ice gouging from one year to the next depending on the preceding winter's ice conditions. Barnes et al., (1978) used statistical estimates to predict that over half of the bottom would be reworked to a depth of about 20 centimeters within 50 years or less. This depth of reworking would be sufficient to disturb any archeological deposits that might have survived the transgression because the site would not be deeply stratified.

Significant information was also accumulated through sediment coring which indicated that the bottom had been highly reworked, that the sediments were homogeneous, and that there was ". . . an absence of lateral continuity over distances of a few tens of meters . . . ." (Barnes and Reimnitz, 1979).

Another factor arguing against the identification of prehistoric cultural resources through topographic landforms in the Beaufort Sea is the dynamic movement of areas of former high relief to form what are now shoals. Such shoals currently migrate between 25 to 200 meters per 200 years along the seabed. Any cultural resources, according to Barnes (personal communication), would be deeply buried or most likely internally reworked, then dropped out to be scattered in the path of the shoal.

We have briefly summarized some of the significant geological and geophysical research conducted in the Beaufort Sea. Based on the accumulated data, it is our position that prehistoric cultural resources would not have survived the marine transgression. It is our contention that, if any would have survived, the processes of ice gouging or the dynamic migration and reworking of shoals would have disrupted any in situ remains. For a more detailed analysis of the impacts to cultural resources, see Appendix I.

Step 4--Review to identify significant landforms

Step 4 calls for the examination of the ". . . geology report, appropriate hazard survey, etc., . . ." to determine the likelihood of significant landforms and the habitability and survivability of such possible sites. Examination of sonographs, fathograms, and sub-bottom seismic profiles generated for the sale area indicate that significant landforms are not recognizable. The geophysical records examined were from the following sources: Barnes and Reimnitz, 1974; Reimnitz and Barnes, 1975; Barnes et al., 1977; Barnes and Reimnitz, 1978; Reimnitz et al., 1978; Barnes and Reimnitz, 1979; Rearic et al., 1981; and Grantz et al., 1982.

According to archeological information collected and analyzed over the last 100 years, early man was most likely to have inhabited areas now identified as drowned stream canyons, passes, ancient estuaries/lagoons, and channel-filled bays.

Due to the destructive forces in action in the proposed sale area which are documented in Appendix 1, such landforms are no longer recognizable. Thus, no prehistoric sites are expected to have survived the marine transgressions.

Step 5--Prehistoric site potential recommendation

Step 5 calls for the integration of all available data and information in order to make a recommendation as to which blocks should be designated as having a high potential for prehistoric sites.

As a result of our five-step assessment, we find that no blocks (a) have the potential for prehistoric sites, (b) contain landforms significant for human habitation, (c) nor contain enough Holocene sediments for site protection and preservation. The cultural resource survey report requirements should not apply to any blocks located in the sale area.

Early man has occupied the Beaufort Sea shelf area during the past 18,000 years, but there is little chance that any of his habitation sites would have survived the tremendous amount of ice gouging. If a prehistoric site did survive, it is very unlikely that it could be detected by present seismic reflection methods, as the subsurface sediments are so jumbled and homogenized that they do not give good returns on the records. In summary, it appears that ice gouging and scouring of the sea bottom preclude survival of a prehistoric site anywhere in the sale area.

If new data become available, this analysis could be refined to further assess which blocks would require a cultural resource report for potential prehistoric sites.

Review of the Beaufort Sea Ice-Gouge Data for
Lease Sale No. 87 Archeological Analysis

Summary

An analysis of various data sources, including fathograms, sub-bottom seismic profiles, and side-scan sonar records, indicate that there is very little likelihood that prehistoric sites in the proposed Lease Sale No. 87 area (sale area) could have survived the extensive ice gouging experienced in this part of the OCS. The data demonstrate that only limited portions of the shelf have been free from ice gouging since the retreat of the Pleistocene ice sheet approximately 18,000 years before present. A dynamic environment, in which ice plays the dominant role in shelf morphology, exists year round. Repeated scouring and plowing of the bottom by ice rotate blocks of sediment, homogenize the sediments, and disturb or obliterate any soil structure developed.

Sea-Ice Zonation

Barnes et al., (1978) divided the sea ice into three zones based on bathymetry and ice characteristics: (1) the bottom fast-ice zone inside the 2-meter isobath where ice at the end of the season of ice growth rests on the sea floor, (2) the zone of floating fast-ice which occurs from the 2 to 10-meter isobath and is up to 2 meters thick, with inclusions of remnants of older ice, and (3) the stamukhi zone in 10- to 20-meter depths which forms the seaward edge of the floating fast ice as a series of major grounded ice ridges.

Zone Characteristics

1. Bottom Fast-Ice Zone

The seabed in the bottom fast-ice zone (Figure 1) has been extensively scoured due to the action of tidal and offshore currents moving the ice vertically and horizontally. Barnes et al., (1977) noted that this zone is marked with depressions, some over 4 meters deep. These depressions, "strudel scour," occur where fresh river water forms pools on the ice during spring river breakup. These pools periodically drain at holes and cracks in the ice to scour the bottom as it flows seaward under the ice (Figure 2). The vertical and horizontal ice movements and extensive "strudel scour" preclude a survival of prehistoric sites in this zone. In addition, this zone lies inside the 2-meter isobath and generally within State waters and, therefore, would not be considered for OCS cultural resources. However, it is worth noting that, as sea level moved landward, present portions of the OCS which were prehistoric beaches would have been exposed to this process.

2. Floating Fast-Ice Zone

Seaward of the bottom fast-ice is the floating fast-ice zone which is a relatively smooth ice field (with randomly scattered ice blocks) extending seaward from approximately the 2- to the 10-meter isobath. At this junction there is interaction with the moving polar pack forming the highly deformed ridges of the stamukhi zone. The ice-gouge scours in this zone are the result of year-round gouging of the sea floor by numerous huge ice blocks derived

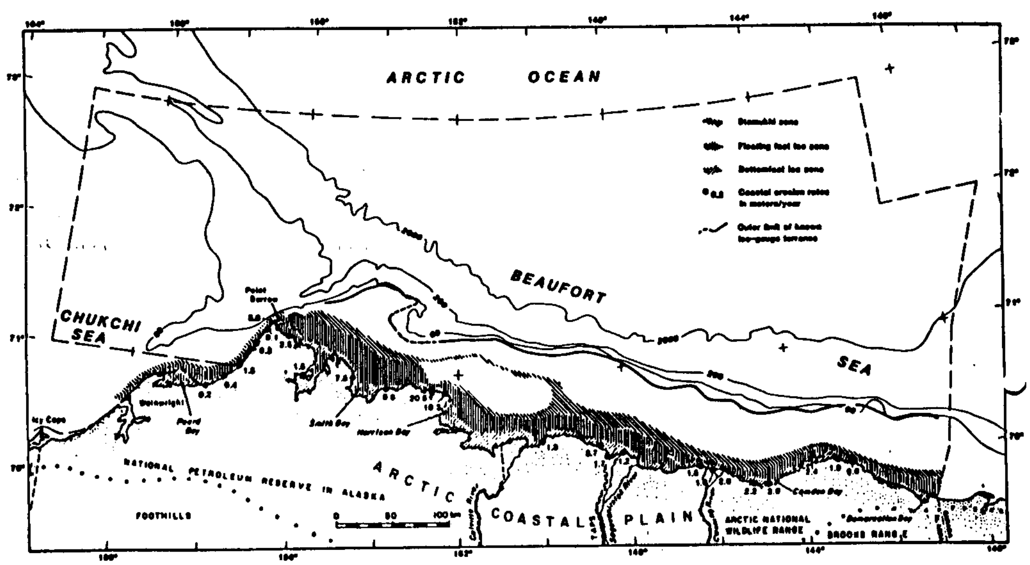

Figure 1. Coastal hazards and ice zonation on the Alaskan Beaufort and northeast Chukchi shelves (from Grantz et al., 1982).

from the stamukhi zone. Winter gouging is caused by rotation of the ice field in which the blocks are frozen and summer gouging is caused by wind and currents acting on the ice blocks.

The floating fast-ice zone is the area which has been most extensively studied for ice-gouge characteristics. Barnes and Reimnitz (1979) found that most ice-gouge features are linear and trend parallel to the bottom contours. A study of two survey lines off the Colville River delta (Barnes, McDowell, and Reimnitz, 1978) reported that the deepest gouge observed was 1.8 meters, and the maximum observed gouge width was 70 meters. It was noted that the frequency of the gouges tends to increase with water depth (Figure 3). The areas with the lowest values of gouge frequency are (1) low slope, (2) inshore of submerged ridges, and (3) in shallow water. A large number of ice-gouge events is expected in shallow water due to the greater abundance of ice keels which increase the probability of a deep gouge. Areas of higher elevation and islands during earlier sea level stands were ideal for grounded ice and thus particularly vulnerable to extensive ice gouging. Repeated ice gouging of these features results in destruction of their surficial sediment structures.

To ascertain how often gouging occurs and how extensively gouging reworks the bottom sediments, Barnes et al., (1978) statistically calculated the fraction of the bottom impacted by gouges within a time interval between various surveys, using the length of the test lines and the incision widths of new gouges. After considering the amount of yearly "replow," it was calculated that, along the test lines, the fraction of the bottom gouged each year was between 1 and 2 percent. This suggests that the bottom in the fast-ice zone is completely reworked to depths greater than 20 cms in less than 200 years which is short compared to the time period that the seabed has been subjected to gouging during the Holocene. During the past 4,000 to 5,000 years, there has been little change in sea level; therefore, there has been a period of at least 4,000 years where ice gouging has many times completely covered any area in the fast-ice zone.

The extensive ice gouging in this zone makes it unlikely that a prehistoric site could have survived.

3. Stamukhi Zone

The stamukhi zone between the 10- and 20-meter isobaths is a belt of differential ice motion or slippage between the relatively stable fast ice and the mobile polar pack. It is characterized by large shear ridges, pressure ridges, and hummock fields. Barnes and Reimnitz (1974) report a sudden increase in ice-gouge density and sediment disruption in this zone. The stamukhi zone is one of very high density of ice-gouging. Reimnitz et al., (1978) state that the zone broadly straddling the 20-meter isobath is the locus of the strongest interaction between the ice pack and the sea floor.

The intensity of ice gouging is expected to be much greater within the stamukhi zone, as this zone experiences the most intense ice deformation. Various studies have confirmed this and have concluded that higher rates of ice gouging and ice-bottom interaction are related to steeper bottom slopes,

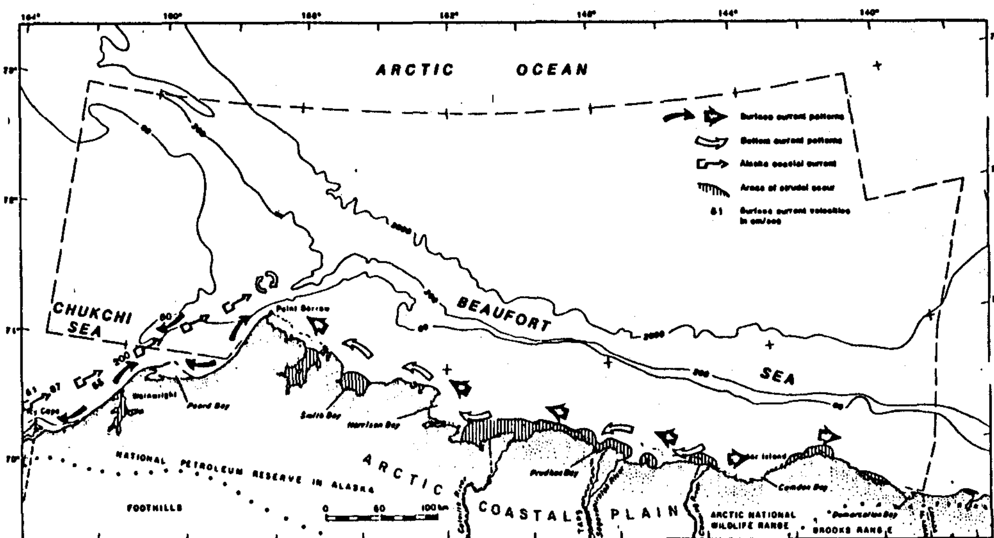

Figure 2. Current patterns and regions of strudel scour on the Alaskan Beaufort and northeast Chukchi shelves (from Grantz et al., 1982).

local topographic highs, and geographic exposure to drifting ice. The dominant trend of gouges parallels the bottom topography, and submerged ridges tend to "steer" gouges parallel to their elongated trend. Gouges are formed during both the open water and the ice-covered periods of the year. This zone is the most extensively ice-gouged with 100 percent coverage in only a few years which would eliminate any chance of prehistoric site survival.

Sedimentation as Related to Ice Gouge

Ice gouging is a dynamic process which causes extensive mixing of the surface sediments. In some areas with water depths up to 30 meters, this process is frequent enough to entirely rework the sediments at least once every half century (Reimnitz and Barnes, 1975).

Preliminary interpretation of high resolution seismic reflection data (Barnes and Reimnitz, 1974) suggests that the entire shelf contains, on average, less than 10 meters of Holocene sediments (Figure 4). Sedimentation rates on the Canadian Beaufort Shelf range from 0.3 meter to 1 meter per 1,000 years. This is quite small and would not keep up with the ice gouging rate. Even in some areas of slight uplift on the Beaufort Shelf where an adjacent area receives greater sedimentation (i.e., the small Holocene syncline just north of Demarcation Bay), the total Holocene sediments are only about 20 meters thick. In 10,000 years this rate is only an average of 0.002 meter per year and would not keep up with the ice-gouging rate on the inner shelf.

Barnes and Reimnitz, (1974) mention that care must be exercised in interpreting rates of sedimentation on the Beaufort Shelf because of the disruptive processes that act on the sediments in the Arctic including ice gouging at all depths and strudel scouring near the coast. They state that the depth of ice gouges (up to 5 meters) and their density (up to 100 or more per kilometer) effectively destroy any lateral continuity of sediment beds on the shelf.

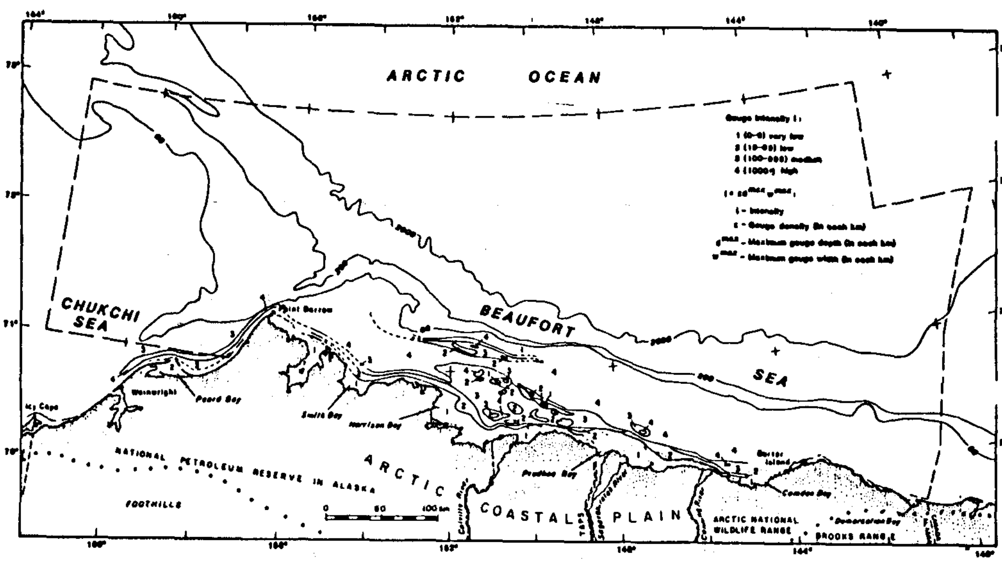

Figure 3. The ice gouge intensity of the Alaskan Beaufort and northeast Chukchi shelves. Ice gouge intensity is a product of maximum gouge incision depth, maximim gouge width, and gouge density per kilometer of ship's track (from Grantz et al., 1982).

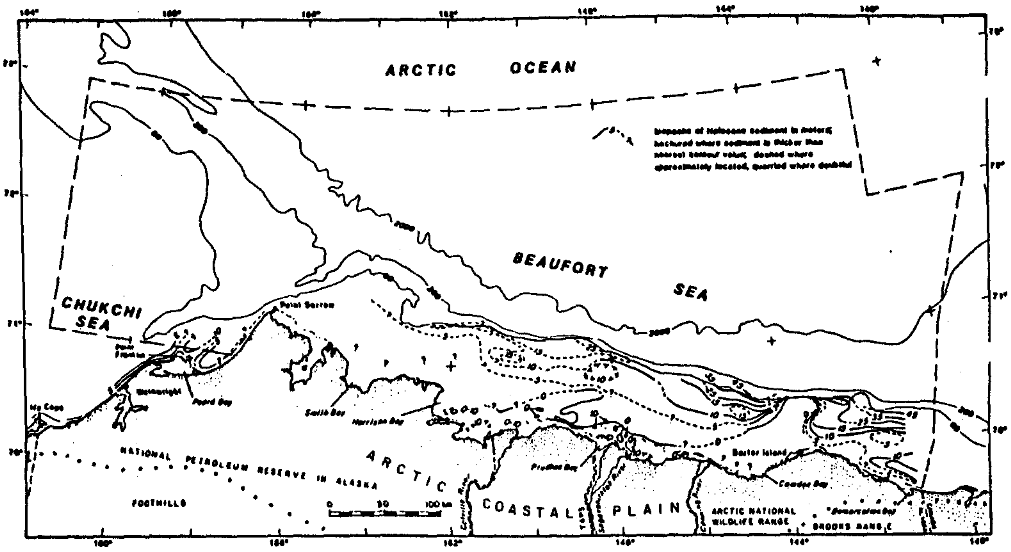

Figure 4. Holocene marine sediment thickness on the Alaskan Beaufort and northeast Chukchi shelves (from Grantz et al., 1982).

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Table H-1
Sale 97 Shipwrecks and Archaeological Resources Relative to OSRA Segments

OSRA SEG. NO.1/	NO. OF SHIPWRECKS2/	LOW (L) HIGH (H)3/	NO. OF CULTURAL SITES 4/	LOW (L) OR HIGH (H)5/	COMBINED RANK6/	TYPE OF SEG.7/
1	2	H	3	L	HL	III
2	0	L	2	L	LL	(IV)
3	0	L	2	L	LL	(IV)
4	0	L	6	H	LH	II
5	0	L	3	L	LL	(IV)
6	0	L	2	L	LL	(IV)
7	0	L	1	L	LL	(IV)
8	0	L	1	L	LL	(IV)
9	0	L	2	L	LL	(IV)
10	0	L	2	L	LL	(IV)
11	0	L	1	L	LL	(IV)
12	0	L	23	H	LH	II
13	2	H	5	H	HH	I
14	0	L	1	L	LL	(IV)
15	38	H	6	H	HH	I
16	0	L	2	L	LL	(IV)
17	0	L	5	H	LH	II
18	0	L	1	L	LL	(IV)
19	4	H	6	H	HH	I
20	24	H	2	L	HL	III
21	0	L	1	L	LL	(IV)
22	0	L	14	H	LH	II
23	0	L	1	L	LL	(IV)
24	0	L	1	L	LL	(IV)
25	0	L	9	H	LH	II
26	0	L	2	L	LL	(IV)
27	0	L	1	L	LL	(IV)
28	0	L	0	L	LL	(IV)
29	0	L	1	L	LL	(IV)
30	0	L	1	L	LL	(IV)
31	0	L	2	L	LL	(IV)
32	0	L	5	H	LH	II
33	0	L	12	H	LH	II
34	0	L	1	L	LL	(IV)
35	0	L	4	H	LH	II
36	0	L	12	H	LH	II
37	0	L	1	L	LL	(IV)
38	0	L	5	H	LH	II
39	0	L	9	H	LH	II
40	0	L	8	H	LH	II
41	0	L	8	H	LH	II
42	0	L	5	H	LH	II
43	0	L	3	L	LL	(IV)
44	0	L	9	H	LH	II
45	0	L	3	L	LL	(IV)
46	0	L	9	H	LH	II
47	0	L	0	L	LL	(IV)
48	0	L	0	L	LL	(IV)
49	0	L	0	L	LL	(IV)
50	0	L	0	L	LL	(IV)
51	0	L	0	L	LL	(IV)
52	0	L	0	L	LL	(IV)
53	0	L	0	L	LL	(IV)
54	0	L	0	L	LL	(IV)
55	0	L	0	L	LL	(IV)
56	0	L	0	L	LL	(IV)
57	0	L	0	L	LL	(IV)
58	0	L	0	L	LL	(IV)
Mean	1		4			

Source: MMS, Oil-Spill-Risk Analysis, Sale 87 FEIS (USDOI, MMS, 1984).

1/ Oil-spill probabilities (expressed as percent chance) of one or more spills occurring and contacting land segments over the expected production life of the sale area. Probabilities are for spills of 1,000 barrels and greater.
2/ Low (L) is below Mean=1; High (H) is above Mean=1.
3/ Shipwrecks are from MMS Computer File, Tornfelt, E., 1985.
4/ Known sites are from Alaska Heritage Resources File, 1985.
5/ Low (L) is below Mean=4. High (H) is above Mean=4.
6/ Combined rank is the rank high or low for both shipwrecks and number of sites.
7/ Type of segment is arbitrary naming HH=I, LH=II, HL=III, and LL=IV.

Table H-2
Number of Segments in Each Segment Type
(I=HH, II=LH, III=HL, IV=LL)

		CULTURAL SITES		
		HIGH	LOW	TOTAL
SHIPWRECKS	HIGH	3	2	5
	LOW	16	37	53
		19	39	58

Source: Table H-1.

Table H-3
Sale 97 Shipwrecks and Archaeological Resources (Type I, II, III)
Relative to OSRA Segments

OSRA Segment No.1/	No. of Ship-wrecks	No. of Archaeological Sites	OSRA Probabilities Proposal2/ Winter Case	OSRA Probabilities Cumulative	Descr. Name	Summary of Effects (Proposal)	Summary of Effects (Cumulative)
Type-I Segment3/							
13	2	5	n4/	n	Wainright	MINOR	MODERATE
15	38	6	n	n	Pt. Belcher	MINOR	MODERATE
19	4	6	1	2	W. Barrow	MINOR	MODERATE
Type-II Segment5/							
4	0	6	n	n	1/	MINOR	MINOR
12	0	23	n	n	1/	MINOR	MINOR
17	0	5	n	n	1/	MINOR	MINOR
22	0	14	1	4	1/	MINOR	MINOR
25	0	9	n	n	1/	MINOR	MINOR
32	0	5	n	3	Nuiqsut	MINOR	MODERATE
33	0	12	n	6	1/	MINOR	MODERATE
35	0	4	1	6	Endicott	MINOR	MINOR
36	0	12	1	1	1/	MINOR	MINOR
38	0	5	2	5	1/	MINOR	MINOR
39	0	9	n	1	1/	MINOR	MINOR
40	0	8	n	n	1/	MINOR	MINOR
41	0	8	n	1	Kaktovik	MINOR	MODERATE
42	0	5	1	4	1/	MINOR	MODERATE
44	0	9	n	n	1/	MINOR	MINOR
46	0	9	n	n	1/	MINOR	MINOR
Type-III Segment6/							
1	2	3	n	n	Cape Lisburne	MINOR	NEGLIGIBLE
20	24	2	3	6	E. Barrow	MINOR	MINOR

Source: MMS, Alaska OCS Region Computer File (Tornfelt, 1985)

1/ See Figure III-20 for geographic location of segments.
2/ Combined probabilities are for spills of 1,000 barrels or greater after 10 days. (See Appendix F, Table F-21.)
3/ Type-I segments are above the mean number of wrecks and sites.
4/ "n" is less than a 0.5% chance.
5/ Type-II segments are above the mean number of cultural sites.
6/ Type-III segments are above the mean number of shipwrecks.
Type IV segments are below the mean on both wrecks and sites. The mean number of shipwrecks is 1; the mean number of cultural sites is 4.

Table H-4
Blocks in the Beaufort Sea Sale Area
Where Shipwrecks Probably Occurred

Official Protraction Diagram	Block Number	Number of Wrecks
NR 4-1:	370	1
	460	1
	501	1
	503	1
	504	1
	548	1
	630	1
	633	2
	638	1
	687	3
	721	1
	771	1
	976	1
	984	1
Subtotal:		17
NR 4-2:	501	1
	502	1
	503	1
	548	1
	630	1
	633	2
	637	1
	677	4
	720	1
Subtotal:		13
NR 5-1	509	1
	514	1
	556	1
	561	1
	599	1
	605	1
	642	1
	648	1
	651	1
	652	1
Subtotal:		10
NR4-4:	46	1
Subtotal:		1
Total:		41

Note: A shipwreck in State waters--the Reindeer, wrecked in 1894-- occurred at NR 6-3, Blocks 562 and 563.

Source: MMS, Alaska OCS Region.

SHIPWRECK UPDATE ANALYSIS
FOR PROPOSED SALE 97

This report is written in accordance with Chapters 1, 2, 7, and 8 of the Minerals Management Service's OCS Oil and Gas Prelease Procedures, MMSM 620.1-H: Handbook for Archaeological Resource Protection. The handbook states that if baseline studies exist to detect the potential for shipwrecks to be affected, then a shipwreck-update analysis should be done to determine (1) if there is the potential for any shipwreck resources occurring in the proposed lease-sale area to survive marine transgression and other physical processes and (2) if the resource can be detected by state-of-the-art geophysical technology.

Baseline studies of shipwrecks exist: A State of Alaska computer file includes most ships wrecked in Alaska (State of Alaska, 1986); two technical papers on Cultural Resources and Shipwrecks exist (Tornfelt, 1981, 1982); a computer file with details of about 500 shipwrecks exists at the MMS Alaska OCS Region; and an MMS report on shipwrecks in all of the Alaskan OCS planning areas is in final preparation (Tornfelt, 1987). These studies show general locations for shipwrecks and, in some cases, archaeological sites. A list of blocks and the number of shipwrecks in each block are shown in Table H-4.

The MMS Archaeological Analysis of the Proposed Lease Offering for the Barrow Arch Offshore Area (USDOI, MMS, 1987, Appendix E) and the Beaufort Archaeological Analysis, 1986, are adequate analyses of the probabilities of any prehistoric site surviving outside of the 3-geographical-mile line. This MMS report concludes that because of the extensive ice gouging, sparse sediment cover, and lack of landforms in the lease-sale area, there is little probability that a prehistoric site exists or could survive. New information that has not changed this conclusion is included in the Prehistoric Resource Analysis in this Appendix (areas shoreward of the 3-mile line are not covered in this analysis).

However, for shipwrecks, the situation is somewhat different than for prehistoric sites or landforms. Shipwrecks may have survived in the area just northeast of Point Barrow and northeast and west of Peard Bay and Point Franklin--simply because the waters there are deep and ice gouging is sparse--and in some shallower areas because the shipwrecks have been there only a short time compared to prehistoric landforms (see Tornfelt, 1987). The shipwrecks, therefore, have increased chances of surviving some ice gouging.

APPENDIX I

SUPPORTING TABLES FOR SECTION III.D.1, ECONOMY OF THE NORTH SLOPE BOROUGH, AND SECTION IV.B.10, EFFECTS ON THE ECONOMY OF THE NORTH SLOPE BOROUGH

I

TABLE I-1 DIRECT EMPLOYMENT ASSUMPTIONS PER UNIT OF WORK FOR PROPOSED SALE 97 - BY WORK TYPE

TYPE OF WORK (one unit) AND ASSOCIATED TASKS	CREW SIZE (a)	SHIFT FACTOR (b)	ROTA-TION FACTOR (c)	NUMBER OF AIRCRAFT OR BOATS	TOTAL WORKFORCE (d)	DURATION (MONTHS)	TOTAL WORK-MONTHS	OF OUT-OF-STATE COMMUTERS (percent)
DRILLING AN EXPLORATION OR DELINEATION WELL								
Drilling Crew Activities	50	2	2.0	-	200	3.0	600	79.0
Helicopter Support for Drilling	5	1	2.0	1.5	15	3.0	45	47.5
Supply/Anchor Boats for Drilling Support	12	1	2.0	3.0	72	3.0	216	58.0
Longshoring Support for Drilling	6	1	2.0	-	12	3.0	36	35.0
Other Onshore Work in Support of Drilling	4	1	2.0	-	8	3.0	24	79.0
CONSTRUCTING AN EXPLORATION SHORE BASE	67	1	2.0	-	133	12.0	1600	79.0
OPERATING AN EXPLORATION SHORE BASE (1 YEAR)	10	2	2.0	-	40	6.0	240	79.0
CONDUCTING A GEOLOGICAL-GEOPHYSICAL SURVEY	30	1	2.0	1.0	60	3.0	180	79.0
CONSTRUCTING AN EXPLORATION ISLAND								
Construct Ice Road	6	2	2.0	-	24	2.00	48	70.0
Haul Gravel in Trucks	136	2	2.0	-	544	2.16	1175	70.0
Haul Gravel in Barges	125	2	2.0	-	500	1.33	665	70.0
Construct Island from Barge Mounted Camp	44	2	2.0	-	176	1.33	234	70.0
INSTALLING A PRODUCTION PLATFORM (& EQUIP)								
All Work by Platform Installation Crews	150	2	2.0	-	600	10.0	6000	89.5
Helicopter Support-Platform Installation	5	1	2.0	2.0	20	10.0	200	47.5
Tugboat Support for Platform Installation	10	1	1.5	4.0	60(e)	1.0	60	58.0
Supply/Anchor Boat Support-Platform Inst.	13	1	1.5	3.0	59(e)	10.0	585	58.0
Longshoring for Platform Installation	20	1	1.5	-	30(e)	10.0	300	35.0
Other Onshore Support for Platform Inst.	25	1	1.5	-	38(e)	10.0	375	89.5
INSTALLING AN OFFSHORE LOADING PLATFORM								
All Work by Platform Installation Crews	50	2	2.0	-	200	2.5	500	89.5
Helicopter Support-Platform Installation	5	1	2.0	2.0	20	2.5	50	47.5
Tugboat Support for Platform Installation	12	1	2.0	1.0	24	1.0	24	58.0
Supply/Anchor Boat Support-Platform Inst.	12	1	2.0	2.0	48	2.5	120	58.0
Longshoring for Platform Installation	6	1	2.0	-	12	2.5	30	35.0
Other Onshore Support for Platform Inst.	8	1	2.0	-	16	2.5	40	89.5
CONSTRUCTING A PRODUCTION SHORE BASE	50	2	2.0	-	200	12.0	2400	47.5
DRILLING A PRODUCTION OR SERVICE WELL	28	2	2.0	-	112	3.0	336	79.0
LAYING OFFSHORE OIL PIPE (100 MILES)								
All Work of Laying Barge Crews	175	2	2.0	1.0	700	3.3	2310	89.5
Helicopter Support for Pipe Laying	5	1	2.0	1.0	10	3.3	33	47.5
Tugboat Support for Pipe Laying	10	1	1.5	2.0	30(e)	3.3	99	58.0
Supply/Anchor Boats for Pipe Laying	13	1	1.5	3.0	59(e)	3.3	193	58.0
Longshoring Support for Pipe Laying	20	1	1.5	-	30(e)	3.3	99	35.0
Other Onshore Support for Pipe Laying	35	1	1.5	-	53(e)	3.3	173	89.5
LAYING ONSHORE OIL PIPE (100 MILES)	250	2	2.0	-	1000	6.7	6667	79.0
CONSTRUCTING A MARINE OIL TERMINAL	300	1	2.0	-	600	12.0	7200	47.5
CONSTRUCTING AN ONSHORE PUMP STATION	100	1	2.0	-	200	8.0	1600	47.5
CONSTRUCTING A PRODUCTION ISLAND	225	2	2.0	-	900	3.0	2700	47.5
OPERATING A PRODUCTION PLATFORM (1 YEAR)								
All Work of Platform Operations Crews	40	2	2.0	-	160	12.0	1920	25.0
Helicopter Support-Platform Operations	5	1	2.0	1.0	10	12.0	120	25.0
Supply/Anchor Boats-Platform Operations	12	2	1.5	1.0	36(e)	12.0	432	25.0
Longshoring for Platform Operations	6	1	1.5	-	9(e)	12.0	108	25.0
Other Onshore Work for Platform Operatns	2	1	1.5	-	3(e)	12.0	36	25.0
MAINTENANCE ON ONE MAJOR PLATFORM	10	1	2.0	-	20	4.0	80	25.0
MAINTENANCE ON ONE PRODUCTION ISLAND	28	2	2.0	-	112	3.0	336	25.0
WELL WORKOVERS FOR ONE OIL PLATFORM	10	1	2.0	-	20	6.0	120	25.0
OPERATING A PRODUCTION SHORE BASE (1 YEAR)	40	1	2.0	-	80	12.0	960	25.0
OPERATING A MARINE OIL TERMINAL (1 YEAR)	50	2	2.0	-	200	12.0	2400	25.0

Notes: (a) work-months (180 hours) per shift (b) shifts per rotation
(c) rotations per month: "2.0"--15 days on/15 off schedule, "1.5"--20 days on/10 off schedule
(d) total work-months per month (e) 240 hour work-month

Sources: MMS Employment Model, Alaska OCS Region, 1985; Dames and Moore, 1982

TABLE I-2 SALE 97 DIRECT MANPOWER REQUIREMENTS--BY INDUSTRY, 1986 TO 2010

	1988	1989	1990	1991	1992	1993	1994	1995
PETROLEUM HEADQUARTERS EMPLOYMENT (in Anchorage)	10	14	20	30	40	50	60	70
PETROLEUM MINING (except headquarters jobs)	191	243	243	243	191	139	103	1334
PETROLEUM CONSTRUCTION	133	177	0	0	0	0	278	578
PETROLEUM TRANSPORTATION (air)	11	15	15	15	11	8	1	35
PETROLEUM TRANSPORTATION (marine)	63	84	84	84	63	42	16	174
ALL PETROLEUM RELATED EMPLOYMENT	409	533	362	372	305	239	459	2190

	1996	1997	1998	1999	2000	2001	2005	2010
PETROLEUM HEADQUARTERS EMPLOYMENT (in Anchorage)	70	70	70	70	70	70	70	60
PETROLEUM MINING (except headquarters jobs)	1430	506	506	519	519	539	539	539
PETROLEUM CONSTRUCTION	0	0	0	0	0	0	0	0
PETROLEUM TRANSPORTATION (air)	20	20	20	20	20	20	20	20
PETROLEUM TRANSPORTATION (marine)	90	90	90	90	90	90	90	90
ALL PETROLEUM RELATED EMPLOYMENT	1610	686	686	699	699	719	719	709

Source: MMS Employment Model, 1985

Table I-3
Summary of Assumptions Used for North Slope
Model Medium Existing Conditions Projections

CATEGORY	ASSUMPTION
Population Model	
• Native birth rates and survival rates	Based on 1980 census data for non-Anchorage Alaska Natives
• Age distribution of Non-Native residents	1980 age distribution
• Maximum unemployment rate for Natives (unemployment cannot rise above this rate due to out-migration)	50 percent
• Share of newly unemployed workers who leave the North Slope	20 percent
Employment Model	
• Federal and State government employment	Historical until 1984; then remains at 1984 level of 178
• Support employment	.24 x (resident employment)
• Borough CIP employment	2.02 x (Borough CIP spending in $million)
• Other CIP employment	2.20 x (Borough CIP spending in $million)
• Borough operating employment	13.09 x (Borough operations spending in $million)
• Oil-industry-related employment	Declines gradually from 7,191 in 1986 to 3,344 in 2000 and 1,461 in 2010; based on ISER Map model assumptions
• Minimum number of oil jobs reserved for Natives	Constant at 30
Income Model	
• Per capita transfer income	$1,450 for Natives; 0 for Non-Natives
• Wage rate (all jobs)	$37,500 per year
Labor Market Model	
• Labor force participation rate	Equivalent to 74.1% for adult Natives between ages 19 and 64; 100% for adult Non-Natives. Only 10% of Natives unable to find other work are assumed to be willing to take oil industry jobs
• Share of jobs available to Natives, by type of employment	56% Borough operations jobs 83% of Borough CIP jobs 37% of other CIP jobs 55% of support jobs 32% of Federal and State jobs 2% of oil-industry jobs
Fiscal Model	
• Per capita nonproperty-tax non-interest operating revenues (State and Federal transfers)	Declines from $6,410 in 1985 to $4,210 in 2010 due to drop in state revenues
• State-imposed per capita property tax limit for operating revenues	Constant at 1985 level of $5,009
• Property value	Rises from $12.3 billion in 1985 to $16.3 billion in 1990; then declines steadily to $4 billion in 2010
• Borough CIP expenditures	Decline from $211 million in 1985 to annual level of $5 million after 1990

APPENDIX J

ENDANGERED SPECIES ACT SECTION 7 CONSULTATION AND DOCUMENTATION

J

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. TUDOR RD.
ANCHORAGE, ALASKA 99503

IN REPLY REFER TO:

SE

United States Department of the Interior
William D. Bettenberg, Director
Minerals Management Service
Washington, D.C. 20240

JUL 30 1985

Dear Mr. Bettenberg:

This responds to your July 10, 1985, request to reinitiate consultation, pursuant to Section 7 (a) of the Endangered Species Act (ESA) of 1973, for all operations pertaining to Outer Continental Shelf (OCS) oil and gas leasing and exploration in the Beaufort Sea planning area (Sale 97). Your request for reinitiation of consultation is due to a new delineation of the lease area and because of newly-acquired quantified information relevant to the sale. Earlier biological opinions on OCS activities in the Beaufort Sea were issued on November 9, 1981, (Arctic Area), and July 15, 1983, (Navarin Basin and Diapir Field). Copies of these opinions are attached.

Having reviewed the information you provided on Sale 97 and the opinions issued in 1981 and 1983, we conclude that the findings and provisions of those opinions remain valid. Sale 97, as proposed, is not likely to jeopardize the continued existence of the Arctic peregrine falcon. We do, however, call your attention to the following:

1. The Arctic peregrine falcon was reclassified in 1984 from endangered to threatened. This reclassification does not affect the level of protection provided the subspecies.

2. Two species of plants currently designated as candidates for listing as threatened or endangered occur within the Beaufort Sea coastal region. *Salix ovalifolia* var. *glacialis*, a low-growing willow, is found in sandy soils at Barrow, Collinson Point and Camden Bay. The other species, *Thlaspi arcticum*, is a mustard known from northeastern Alaska where it occurs on well drained sites such as dry ridges and low river terraces. Both plants could be affected by activities such as coastal vehicular traffic, onshore developments, or sand and gravel mining operations. While candidate plants are not afforded protection under the ESA, we feel that agencies, wherever possible, will be interested in protecting such species, thereby reducing the probability that they will require listing. We encourage you to consider them in your environmental planning.

3. The project, as proposed, should not result in the incidental take of listed species and no such take is authorized.

Thank you for your continued interest in the welfare of threatened and endangered species. Questions regarding this opinion may be directed to Dennis Money at 907-786-3435 in Anchorage.

Sincerely,

Robert E. Gilmore

Regional Director

Attachment

cc: Jerry Reid, DTS
Al Powers, MMS

United States Department of the Interior

ADDRESS ONLY THE DIRECTOR, FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

In Reply Refer To:
FWS/OES MMS-83-4

JUL 15 1983

MEMORANDUM

To: Director, Minerals Management Service

From: Deputy Associate Director

Subject: Section 7 Biological Opinion for Proposed Outer Continental Shelf Leasing and Exploration in the Navarin Basin and Diapir Field

This responds to your April 21, 1983, request to reinitiate formal consultation pursuant to Section 7(a) of the Endangered Species Act (ESA), as amended, for Outer Continental Shelf (OCS) oil and gas leasing and exploration in the Navarin Basin (Bering Sea Region, Lease Sale No. 83) and Diapir Field (Arctic Region, Lease Sale No. 87). As with all OCS consultations, it is understood that consultation will be reinitiated should the project advance beyond the exploration phase.

Biological opinions (opinions) were issued for the Bering Sea Region on August 22, 1980, and for the Arctic Region on November 9, 1981 (copies attached). Your reason for reinitiating consultation is to ensure that conclusions contained in the earlier opinions are still valid in view of newly obtained information relative to these proposed sales. Also, the previous opinions addressed the entire Bering Sea and Arctic Sea Regions. In accordance with your request, this reassessment will address only the Navarin Basin and Diapir Field areas.

Navarin Basin

The American and Arctic peregrine falcons (*Falco peregrinus anatum* and *F. p. tundrius*) were the only species included in the 1980 opinion. There is no new information to indicate that additional species should now be considered.

The Fish and Wildlife Service, prior to the winter 1983, had no records of peregrines occurring in or near the Navarin Basin. Surveys of marine birds on St. Matthew Island in 1977 and 1982 found no nesting peregrines. Surveys along the western coast of Alaska have produced only occasional sightings of what were probably migrating peregrines and little evidence of nesting. Between February 24 and March 15 of 1983, however, Fish and Wildlife Service observers aboard the USCG Cutter *Polar Sea* reported eight peregrine sightings 2 to 125 km south and west of St. Matthew Island. The birds were apparently wintering along the ice edge where open water provided habitat for prey species. It is unknown whether peregrines are present in this area annually or whether their presence this year was an anomaly. The subspecific identity of the birds is also unknown. Possibly they are *F. p. calidus* or *F. p. japonensis*, non-endangered races which nest in Siberia, or possibly they are endangered American or Arctic

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peregrines which nest on the mainland of Alaska. Heretofore, all evidence, including band returns, indicates that Arctic and American peregrines are highly migratory and do not winter in or near Alaska. If the observed peregrines are of a non-endangered race, they are by their status excluded from consideration in this consultation.

Considering the expanding populations of peregrines in Alaska, and the improbability of large numbers of peregrines being affected should an oilspill occur, we believe there is little likelihood that oil and gas leasing and exploration in the Navarin Basin will significantly impact endangered peregrines.

Diapir Field

We find the 1981 opinion for the Arctic Region to be current and entirely appropriate. As a reminder, we call your attention to the findings of that opinion:

1. The need to intensively survey, for peregrine falcons, those coastal areas where proposed onshore activities or aircraft traffic may conflict with peregrine nesting.

2. A preference for locating onshore facilities in or near existing villages and away from potential peregrine nesting areas.

3. The need to provide all potential lessees with the document "Recommendations to Avoid Peregrine Falcon Conflicts" which is an attachment to the 1981 opinion.

4. A request that candidate plant species be considered in the planning of all onshore activities that result in ground surface disturbances.

Summary - Biological Opinion

It is my biological opinion that OCS leasing and exploration activities in the Navarin Basin and in the Diapir Field are not likely to jeopardize the continued existence of the American peregrine falcon or the Arctic peregrine falcon.

This opinion does not address oil or gas development or production. Consultation will be required prior to start up of those phases. New information which could alter this biological opinion, the listing of new species which could be affected by the proposed action, or significant modification of the proposed action will also require reinitiation of consultation.

Thank you for your cooperation and for your concern for endangered species.

Roman H. Koenings
Roman H. Koeninge

Attachments

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In Reply Refer To:
FWS/OES BLM/GS-81-3

NOV 9 1981

Memorandum

To: Director, Bureau of Land Management
Director, U.S. Geological Survey

From: Chief, Office of Endangered Species

Subject: Section 7 Biological Opinion, Proposed OCS Oil and Gas Leasing and Exploration in the Arctic Offshore Area

By memorandum of August 28, 1981, (copy attached) the Bureau of Land Management (BLM), on behalf of themselves and the U.S. Geological Survey (GS), requested joint formal consultation on the proposed leasing and exploration in the Arctic Outer Continental Shelf (OCS) region. The proposed leasing consists of OCS Sale No. 71 in the Beaufort Sea, as well as Sales 85 (Chukchi Sea) and 86 (Hope Basin). The combined Federal/State oil and gas lease sale in the Beaufort Sea area has been the subject of a previous biological opinion (July 27, 1978; copy attached).

Since OCS exploration in the Arctic region is likely to involve the construction of gravel islands, it was agreed that BLM should perform a Biological Assessment, as required by Section 7(c) of the Endangered Species Act of 1973, as amended (ESA). To assist with the Biological Assessment, on May 21, 1981, the Fish and Wildlife Service (FWS) provided BLM with a list of Endangered and Threatened species which are under FWS jurisdiction and which might be present in the area of concern (copy attached). Following receipt of the list BLM completed the Biological Assessment and submitted it to FWS with the request for consultation. The Biological Assessment concluded that the listed Arctic peregrine falcon and three candidate plant species may be affected. It also concluded that the Eskimo curlew should not be considered as being present in the area. The FWS concurs with these findings.

During the course of this consultation, the FWS reviewed a number of reports and publications in addition to the Biological Assessment and contacted various individuals by phone. Copies of pertinent reports and records are maintained in an administrative record at the Office of Endangered Species (OES) and are incorporated by reference in this opinion.

Project Description

BLM acts as the Secretary of the Interior's agent in arranging for the processing of bids on offshore oil and gas lease sales. After the issuance of the leases, GS assumes the authority to administer the lease areas. Among other things, this includes the approval of exploratory and development/production plans

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submitted by the lessee. The final Five Year OCS Oil and Gas Leasing Schedule dated June 1980, calls for three proposed sales in the Arctic region between now and June 1985. These three sales include proposed Sale No. 71 in the Beaufort Sea (also called Diapir Field), proposed Sale No. 85 in the Chukchi Sea (also referred to as the Barrow Arch area) and proposed Sale No. 86 in the Hope Basin. An accelerated proposed leasing schedule was published in the Federal Register on July 31, 1981. This new proposed schedule calls for two additional sales, No. 87 and 97, both in the Diapir Field, to be added by June, 1986.

Proposed Sale No. 71 in the Beaufort Sea will be the first of the five areas offered for leasing. At this time, it is the only area in which tracts have been identified for further analysis and possible sale. The 411 tracts identified lie from west of the Canning River to just west of Camp Lonely, with the bulk of the tracts located west of Prudhoe Bay. The tracts range from 3 to 43 miles offshore and in water depths of approximately 67 to 164 feet.

Exploration of the Arctic OCS will almost certainly include the construction of artificial islands built from fill material obtained from sites either offshore or onshore. The average exploratory island will probably be 2 to 3 surface acres and require 0.4 to 1.0 million cubic yards of fill. For tracts in the Chukchi Sea and Hope Basin, ice-strengthened drillships will probably be used. Onshore support facilities, including airports, are expected to be located in Barrow and/or Prudhoe Bay for the Beaufort Sea tracts and in Kotzebue and Cape Lisburne for the Chukchi and Hope Basin tracts.

In any drilling operation there is a possibility of an oilspill. An exploratory well blowout can cause the release of significant amounts of hydrocarbons into the marine environment and may affect listed species. The Campeche, Mexico, oilspill is a dramatic example of an exploration blowout. While the exact causes of the Campeche blowout are likely to remain unknown, it appears that operational procedures, rather than technology, were at the root of the accident. It is thought that this spill could have been avoided had operating procedures used in the United States been employed.

In the United States, OCS Operating Orders require that a number of safety devices and procedures be employed to prevent such an accident. These include the use of blowout preventers, strict drilling procedures, regular testing of safety equipment, training of personnel, regular inspection by GS personnel, and approval by GS of all drilling plans and modifications. According to statistics compiled by GS, the probability of a blowout occurring during exploration in the offshore waters of the United States is remote. These statistics, however, were not generated under Arctic conditions. The Canadians have been drilling in the Beaufort Sea since 1965 and have drilled a total of 33 offshore wells, seven of which have resulted in discoveries. None of these wells have experienced any oilspills. The Canadian experience provides support for the conclusion that a blowout is unlikely to occur during OCS exploration activities.

This biological opinion considers only operations pertaining to oil and gas leasing and exploration in the Beaufort and Chukchi Seas and Hope Basin including proposed OCS Sales 71, 85, 86, 87, and 97. Consultation must be reinitiated

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prior to entering the development/production phases of OCS activities. Although this consultation considers the proposed Sales through June 1986, BLM and GS should remain in close contact with OES to insure that new circumstances which may develop do not impact listed species and that agency obligations to conserve listed species are effectively met. OES concurs with BLM's contention that additional sales proposed for this region constitute new information and that formal consultation should be reinitiated at the appropriate time. Should new species be listed which may be affected, this consultation should be reinitiated. In addition, BLM and GS are required to confer with OES if they determine the OCS activities are likely to jeopardize the continued existence of proposed species or result in the destruction or adverse modification of proposed Critical Habitat.

Arctic Peregrine Falcon (Falco peregrinus tundrius)

The Arctic peregrine falcon was listed as Endangered in 1970, primarily due to population declines associated with chlorinated hydrocarbon contamination. The Alaska Peregrine Falcon Recovery Team has estimated that historically Alaska supported about 150 pairs of Arctic peregines. This population, however, was severely reduced in the late 1960's and early to mid-1970's. Since then, the population has slowly increased. In the 1980 surveys the population was estimated to be 45-50 pairs.

Peregrines are usually present in Alaska from mid-April to mid-September with egg laying on the North Slope beginning in the middle of May. According to the Recovery Team, the primary threat to peregrines during the nesting season is human disturbance.

The physical presence of humans, use of aircraft, or other intrusions near eyries can result in injury or death to peregrines and abandonment of nest sites. Abrupt disturbances can cause adults to flush from an eyrie causing egg breakage, injury to young, or premature fledging which could result in injury or death of young. Even temporary abandonment of eyries can result in overcooling or overheating of eggs or young, malnutrition in young, and predation of eggs or young by other species. Helicopter and fixed-wing aircraft noise and movement may be taken as a threat and may cause a peregrine to flee the eyrie or attack the aircraft. Experience in Alaska and elsewhere has shown that nest sites near sustained human activity are more likely to be abandoned.

These adverse impacts on peregrine falcons are generally avoidable when eyrie locations are known. The Biological Assessment which BLM provided with their request for consultation identifies the locations of the known eyries. The data we currently possess on coastal peregrine nesting is largely information gathered incidental to sea bird survey work. In other words, people were not looking for peregrine falcons so the likelihood of missing nest sites was high. Some authorities believe there could be as many as 6 to 8 undiscovered nesting pairs between Cape Lisburne and Kotzebue. Although no sites are currently known, there is evidence which indicates that coastal nesting may occur along the North Slope. This speculation points out the need to intensively survey coastal Alaska for Arctic peregrine falcons.

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The impacts of OCS leasing and exploration on Arctic peregrines can range from little or no effect to severe adverse effects depending upon where activities take place. As stated earlier, the primary threat to nesting peregrine falcons in Alaska is human disturbance. OCS activities can add significantly to this threat. If onshore facilities are limited to Barrow, Prudhoe Bay, Kotezebue, and Cape Lisburne and are not located within the nesting territories of Arctic peregrines, these facilities would have no effect on the falcons. Airplane and helicopter traffic would pose little or no threat if existing facilities are used and a minimum altitude of 1500 feet is observed. Likewise, gravel operations, if conducted offshore, would pose no threat. Unfortunately, none of these conditions can be guaranteed since no one knows where these activities will be required and BLM and GS do not possess the authority to regulate onshore activities (including air traffic). BLM will, however, inform all potential lessees of the protection that Arctic peregrine falcons receive under the ESA and of the possible conflict between exploration activities and peregrine falcons. BLM will also provide a series of four recommendations, concurred in by FWS, which should avoid peregrine falcon conflicts (attached).

Candidate Species

As noted in our memo of May 21, 1981, (attached) there are several candidate plant species which could be impacted by OCS exploration and its associated onshore facilities. While candidate plants are afforded no protection under ESA, we feel that agencies, wherever possible, will be interested in protecting such species and thus reducing the probability that they will need to be listed. In this case, it is recommended that surveys be done prior to any onshore construction or gravel mining to insure that these candidates are not further depleted.

Cumulative Effects

Cumulative effects are considered to be the direct and indirect effects of actions that are interrelated or interdependent with the action under consideration. Indirect effects of the action under consideration are those that are caused by the activity and are later in time or farther removed in distance, such as the progression from leasing OCS tracts, to exploration, and ultimate development/production of the hydrocarbon resources. Other actions will be considered interrelated with the action if they are all part of a larger action, and other actions will be considered interdependent if they do not have significant independent utility apart from the action that is under consideration. Under this definition cumulative effects would include development and production resulting from any of the lease Sales considered. It is impossible at this point to determine if and where any finds of commercial significance are likely to be made. With that in mind, it is the agreed upon practice to require reinitiation of consultation when these tracts enter the development/ production phases of OCS activities. Therefore, any development/production actions will be consulted upon at a later time.

Conclusion

Based on the above discussion and the likelihood that exploratory activities will be limited to Barrow, Prudhoe Bay, Kotzebue, and Cape Lisburne it is my

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biological opinion that OCS leasing and exploration activities in the Arctic region are not likely to jeopardize the continued existence of the Arctic peregrine falcon. This biological opinion concerns only the leasing and exploration of the Arctic OCS resulting from proposed lease Sales 71, 85, 86, 87, and 97, as described above. This does not include any development or production which could result if oil or gas is discovered by exploratory drilling. As has been previously mentioned, development and production activities will require reinitiation of consultation. Consultation should also be reinitiated if significant, new information is developed which could alter the biological opinion, if new species are listed which could be affected by the proposed action, or if the proposed action is significantly modified.

I would like to express my appreciation to all involved parties for their cooperative efforts during the course of this consultation. I hope that this cooperative attitude can be maintained throughout the period of OCS activities in the Arctic. BLM and GS are aware of their continuing responsibilities under ESA to utilize their authorities to conserve listed species and close cooperation at the field level will greatly increase the effectiveness of efforts to meet those responsibilities.

Attachments

/s/ Janice F. Hill

cc: Ralph Ainger, BLM
Skip Ambrose, FWS
Dennis Money, FWS
Jack Edmundson, OES
Mary Ann Turner, GS
Ray Fritz, FWS
Jerry Reid, FWS

FWS/OES:Edmundson:mbn:draft-10/27/81,final-11/6/81

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(Page J-5 not used)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Washington, D.C. 20235

MAY 20 1987

Mr. William D. Bettenberg
Director
Minerals Management Service
U.S. Department of the Interior
Washington, D.C. 20240

Dear Mr. Bettenberg:

Enclosed is the Biological Opinion prepared by the National Marine Fisheries Service (NMFS) under Section 7 of the Endangered Species Act (ESA) concerning OCS Lease Sale 97 in the Beaufort Sea.

NMFS concludes that the leasing and exploration phases of Lease Sale 97 are not likely to jeopardize the continued existence of any endangered or threatened marine species. In formulating this opinion, NMFS used the best available information, including the recent material submitted by the Minerals Management Service (MMS) on the probability of an oil blowout from exploratory drilling and the results of research available since the issuance of previous opinions for the Beaufort Sea planning area.

Although we have concluded that the activities are not likely to jeopardize the bowhead whale, the Service is concerned about the potential effects of oil and noise associated with Lease Sale 97 particularly combined with ongoing and future exploration, production and development activities throughout the range of the bowhead whale. We urge MMS to continue studies on the potential effects of OCS activities on endangered whales so that the necessary information will be available for future consultations, including those on development and production. Conservation recommendations are provided with the opinion concerning these information needs and concerning actions that MMS can take to minimize potential impacts to bowhead whales.

In addition to our opinion on the incremental step (leasing and exploration), NMFS is providing its views on the entire action, including development and production. Under 50 CFR Section

402.14(k) of the Section 7 regulations, there must be a reasonable likelihood that the entire action will not violate Section 7(a)(2) of the ESA for the Federal agency to proceed with the incremental step. Based on currently available information and technology and the absence of effective mitigating measures, we believe that development and production activities in the spring lead systems used by bowhead whales for their migration would be likely to jeopardize the population. This potential for jeopardy should be recognized as early as possible so that the oil companies will be aware of possible future restrictions. We have included reasonable and prudent alternatives to the action to avoid jeopardy. In addition, NMFS will reconsider this conclusion when new information, technology, and/or measures become available or are proposed that would effectively eliminate or otherwise mitigate this potential jeopardy situation.

The Service has not provided an incidental take statement for endangered whales and any taking of whales is prohibited. Section 7(b)(4)(C) of the ESA specifies that in order to provide an incidental take statement for listed marine mammals, authorization under Section 101(a)(5) of the Marine Mammal Protection Act (MMPA) is required. No taking of endangered whales incidental to OCS leasing and exploration activities has been requested or authorized. Requests should be submitted in accordance with 50 CFR Part 228 and the recent amendment to the ESA and MMPA (copy enclosed). If you have any questions concerning the incidental take provisions, please contact Patricia Montanio of the Protected Species Management Division (FTS 673-5351).

Sincerely,

James E. Douglas, Jr.

for William E. Evans
Assistant Administrator
for Fisheries

Enclosure

Endangered Species Act - Section 7 Consultation

BIOLOGICAL OPINION

Agency: Minerals Management Service

Activities: Oil and Gas Leasing and Exploration - Beaufort Sea Sale No. 97

Consultation Conducted By: National Marine Fisheries Service

Date Issued: ________________

Background:

The Minerals Management Service (MMS) of the Department of the Interior (DOI) is proposing a fourth federal oil and gas lease sale in the Beaufort Sea off Alaska. This sale, called Beaufort Sea Lease Sale 97, is scheduled to be held in January 1988. The boundaries of the Beaufort Sea OCS Planning Area are shown in Figure 1. On July 10, 1985, MMS requested formal consultation on the effects of leasing and exploration resulting from this lease sale on endangered species. A formal consultation meeting was held in Anchorage, at which time MMS provided the National Marine Fisheries Service (NMFS), Alaska Region, with information on the proposed plans for this sale. Additional information related to this sale was provided to NMFS at later dates during the consultation process, including reports of recent research funded by MMS.

Five consultations have been conducted for previous OCS lease sales in the Beaufort Sea, and NMFS has issued the following earlier Biological Opinions:

- June 24, 1980, (the Joint Federal/State Sale BF);
- April 1, 1982, (a revised opinion for Sale BF);
- April 1, 1982, (an opinion for oil and gas leasing in the Arctic Region in general);
- May 19, 1982, (OCS Sale No. 71 - Diapir Field);
- December 19, 1983, (Diapir Field Sale No. 87).

These Biological Opinions should be refered to for background information.

Proposed Activities:

This is an incremental step consultation covering leasing and exploration activities of OCS Lease Sale 97 (L.S. 97). The proposed activities considered are an oil and gas lease sale to be held in January 1988, followed by a period of exploratory drilling, testing, and surveying. A separate consultation for development and production activities will be conducted if oil is discovered and development plans are proposed. The details of the proposed exploration, development, and production scenarios for this sale are contained in Roberts (1985) and updated with information provided by MMS. The mean resource estimate for L.S. 97 is 650 million barrels of oil with a 69 percent chance of a discovery of commercially recoverable oil. The activities associated with this sale are foreseen to be a continuation of the activities associated with the previous three Beaufort Sea lease sales, with exploration beginning on newly leased tracts the first year following the sale (1989) and continuing for six years (1994). A total of 11 exploration wells and 4 delineation wells are predicted. An estimated 14 of these wells will be drilled by floating units (drillships or drill barges) or by bottom-founded mobile drilling units in waters deeper than 20 meters. One well is projected to be drilled from an artificial gravel island in waters less than 20 meters (MMS, In prep.). Icebreakers and icebreaking supply boats will be used to support the floating units. Associated activities include helicopter flights, supply boat trips, and dredging at some well locations prior to installation of the well-head.

Only shallow-hazards seismic surveys are expected to result from this sale. The total shallow-hazards seismic activity is estimated to cover 963 line kilometers in an area 345 square kilometers over the 6-year exploration period. Deep seismic surveys (airguns) are primarily a pre-lease activity and none are projected to occur as a result of L.S. 97 (MMS, In prep.).

Listed Species and Critical Habitats:

Right, fin, sei, or humpback whales are unlikely to be present in the proposed lease offering area. Some gray whales are usually present during the ice-free months in the northern part of their summer feeding range in the Chukchi Sea. The species of main concern in the Beaufort Sea is the bowhead whale, *Balaena mysticetus*. A review of the status of this endangered whale has recently been published (Braham, 1984).

The size of the Western Arctic population of the bowhead whale is most recently estimated to be 4,417 ±1,804 animals (IWC, 1985). The entire population migrates north through the western portion of the lease area from April through June, following leads in the pack ice through the Chukchi Sea towards Pt. Barrow and the Beaufort Sea. These leads form in the shear zone where the polar pack ice breaks free and moves away from the seasonal shorefast ice zone. In the northern Chukchi Sea, the shorefast ice zone is relatively narrow and the leads open within a few miles of the shore (Braham et al., 1980).

In the Beaufort Sea, the fast-ice zone is broader and the leads are progressively farther offshore as they extend eastward. The lead system at Pt. Barrow is especially narrow and close to shore, and all whales are believed to funnel through the nearshore leads. The width of the lead system varies with ice movements, and is sometimes less than one kilometer in width. East of Pt. Barrow, the spring lead system begins to branch offshore. East of 151° W (approximately the longitude of the Colville River), the leads dissipate into numerous branches that vary in location and extent from year to year. Here, the overall migration corridor widens as multiple leads are used by the whales in their movements to the Canadian Arctic (Ljungblad et al., 1982). Nevertheless, the spring migration appears to be contained between 71°20' N and 71°45' N to at least as far east as the longitude of Barter Island. Past Barter Island, the path of the eastward migration is less predictable, and complex leads branch north and east towards Banks Island.

Bowhead whales appear to be scarce in the Alaskan Beaufort Sea during July where the offshore water is usually still heavily ice-bound. Bowhead whales return to the eastern Alaskan Beaufort Sea as early as the beginning of August. Aerial surveys beginning in August have been conducted in offshore waters of the Beaufort Sea since 1982. Through 1985, bowhead whales have been found in the offshore area east of Barter Island as early as August 2 (Ljungblad et al., 1985a, b). These whales may represent an early, offshore component of the westward fall migration (Ljungblad et al., 1983). Such an offshore component could account for at least part of the small percentage of nearshore sightings compared to the estimated size of the population.

In the L.S. 97 area, bowhead whales can be predicted at the following times and locations: a) in the spring (April through June), southwest of Pt. Barrow in nearshore ice leads within 15 to 20 km of shore, and east of Pt. Barrow in the offshore shear zone between 71°20'N and 71°45'N in water depths between 20 and 200 m (Pt. Barrow to Cape Halkett) and in 200 to 2,000 m water depths (Cape Halkett to US/Canadian Border); b) in the summer (August and perhaps late-July), possibly offshore in 50 to over 2,000 m of water east of Barter Island; c) in the fall (September and October), both offshore, possibly across the entire Beaufort Sea at least as far north as the polar pack-ice, and nearshore along the entire coast until freeze-up in October or November (Braham et al., 1980; Ljungblad et al., 1985a).

In spring, bowhead whales use the Alaskan Beaufort Sea primarily as a migration path. Activities such as calving, socialization, and some opportunistic feeding also occur, but generally the whale movements are purposeful through the area (Braham et al., 1980; Ljungblad et al., 1982, 1985a). Three whales taken by

Barrow natives in the spring of 1985 had stomachs full of zooplankton (George and Tarpley, 1986), as did 4 of 7 harvested in 1986 (George et al., 1987), indicating that at least in some years feeding does occur along the migration path.

Also, in the fall, both feeding and migration activities occur in the Alaskan Beaufort Sea. Certain areas appear to be regularly used for feeding and resting. The best documented feeding area is east of Barter Island including the waters offshore of Demarcation Bay, where bowhead whales repeatedly are observed feeding and resting in the fall (Ljungblad et al., 1982, 1983; McLaren and Richardson, 1985; Richardson et al., 1985c). Bowhead whales have also been observed feeding north of Flaxman Island (Ljungblad et al., 1982), in outer Harrison Bay north and east of the Colville River plume (Ljungblad et al., 1983), and in the waters offshore of Smith Bay and east of Barrow (Braham et al., 1983; Ljungblad et al., 1985a).

Canadian studies suggest that bowheads tend to congregate at locations with significantly higher concentrations of copepods than are present in surrounding waters (Richardson, 1985). The far offshore area east of Barter Island also may be used for feeding, but this has not been confirmed due to the difficulty of determining feeding behavior in deepwater (S. Moore, SEACO, pers. comm.). Such feeding in deep water areas has been inferred in the Canadian Beaufort on a regular basis (McLaren and Richardson, 1985). Feeding in late summer and autumn may be especially important to bowhead whales as this may be the last major feeding period for several months and the energy content, of the zooplankton prey is highest at this time (Lowry and Frost, 1984; McLaren and Richardson, 1985).

Depending on ice conditions and proximity to freeze-up, the bowhead whales appear to alternate feeding and westward migration activities, undoubtedly stopping to feed in areas containing suitable prey unless a strong migration urge (e.g., heavy ice conditions or impending freeze-up) exists. In 1985, there was evidence of feeding while whales were traveling slowly westward as well as at times when they remained in specific areas (Thomson, 1985).

Although whale distribution and relative abundance probably varies from year to year, the available information provides a good indication of the behavior and habitats used by bowhead whales in the Beaufort Sea. Such information can help determine the potential impacts to this endangered species from OCS activities in this area.

There is no critical habitat designated for the bowhead whale or other endangered whales under Section 4 of the Endangered Species Act (ESA).

Assessment of Impacts:

NMFS believes that exploration activities in the Beaufort Sea lease area have the potential to affect adversely endangered whales from oil spills and noise. Because of their low population numbers, their habit of frequenting coastal waters, and their apparently low reproductive rate, bowhead whales may be particularly vulnerable to impacts from offshore oil and gas activities throughout their range (Braham, 1984).

Since the issuance of the biological opinion on L.S. 87 in 1983, a number of studies have been conducted on the possible effects of OCS activities on bowhead whales in the Beaufort Sea. Disturbance responses of bowhead whales to industrial activities have been the focus of a 5-year program in the Canadian Beaufort Sea (Richardson and Green, 1983; Richardson et. al., 1985 a-c). Some direct studies have been conducted in Alaskan waters (LGL, 1986; Miles et al., 1986). Studies on the effects of oil on marine mammals have also continued (Geraci and St. Aubin, 1986).

Oil Spill Risks: Oil spills from OCS drilling are a major concern. An oil spill during the spring in lead systems used by migrating bowhead whales might be critical if a spill were to occur and come in contact with the whales. Oil spills in the fall might affect bowhead whales in feeding areas or along migration paths either through open water or among multi-year or newly forming sea ice.

Oil spill risks from gravel islands or other bottom-founded structures are generally spread out over a period that does not have to coincide with the bowhead migration because their operation is not governed by ice conditions. A blowout from bottom-founded structures is not likely to contact bowhead whales because such structures are used in the shallower waters, generally inside of the migration path, and also because it would be easier to contain and clean up the oil.

Drillships used during exploration, on the other hand, have about a 3-month drilling window overlapping the fall migration period. An oil spill or blowout from a drillship is likely to enter the water. Also, the drilling location is likely to be in or near the migration path. Drillships operating in the fall may also have to temporarily suspend operations and move off the well because of pack-ice encroachment. It is uncertain whether such moves increase the risk of an oil spill or blowout, but it is possible that pack-ice incursions could prevent the capability for completing a relief well, if one is needed.

MMS (1985) projects an estimated mean of 1.7 spills of 1,000 barrels or greater in the lease area as a result of full development of the resource estimate of 650 million barrels, with an estimated mean of 0.07 spills of 100,000 barrels or greater. Cumulative oil spills resulting from this and previous Beaufort Sea lease sales, including the production and transport of 4.6

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billion barrels of Canadian oil, are estimated at 24.4 and 1.04 spills of greater than 1,000 and 100,000 barrels, respectively. These spill estimates are drawn from all wells drilled, including both exploration and production wells. However, most of these statistical calculations are based on production wells. As such, the probability for an oil blowout during exploration is exceedingly small, but this can only be estimated from available statistics. To date, there has been no oil spilled as a result of a blowout during exploratory drilling on the U.S. outer continental shelf. However, there have been gas blowouts (which do not spill oil) associated with exploratory drilling in the U.S. OCS and the Canadian Beaufort Sea.

MMS has recently concluded that the probability of an oil spill resulting from a blowout during exploratory drilling in the Beaufort Sea is extremely unlikely (Attachment 1). They cite several studies of offshore drilling statistics that indicate the risk of a blowout from an offshore exploration well on the U.S. OCS is around 0.64 percent or about 1 blowout per 156 wells drilled. The upper 95 percent confidence level to the probability of an oil blowout of an exploration well is estimated to be equal to or less than 0.0004 percent, or no more than 1 in 250,000 wells drilled. MMS believes that such a low probability does not pose a threat to bowhead whales as a result of an oil blowout from exploratory drilling in the Beaufort Sea.

MMS also cites legal authorities that are in place to ensure safe drilling practices on OCS leases, which further assure that an oilspill from exploratory drilling would be unlikely. Such authorities include operational requirements contained in regulations, OCS Operating Orders, lease stipulations, inspection requirements, and conditions of approval of Exploration Plans, Applications for a Permit to Drill, and Critical Operations and Curtailment Plans.

If an oil spill should occur, however, from either a blowout or an operational discharge, the conditional probabilities (expressed as percent chance) that an oil spill will contact a certain bowhead whale habitat (i.e., spring or fall migration corridors, feeding areas) within 3 to 30 days have been calculated to range from nil (less than 0.5 percent) to 41 percent during the winter or summer (open-water) seasons depending on spill location (MMS, 1985). These contact probabilities are calculated over a nine-month season, and, therefore, include those months when bowhead whales are not present. Since the drilling window for drillships and other floating units, from mid-July or early August to or through November, generally coincides with the fall migration of the bowhead whales through the lease area, these probabilities are not specifically applicable.

Effects of Oil: Assuming an oil spill were to occur and contact whales, the worst case adverse impacts to whales from spilled oil could include death or illness caused by ingestion or inhalation

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of oil, irritation of skin and eyes, fouling of feeding mechanisms, and reduction of food supplies through contamination or losses of food organisms. Albert (1981) speculated that the most likely adverse effects of oil contact to bowhead whales are 1) conjunctivitis and corneal eye inflammation leading to reduced vision and possible blindness; 2) development of skin ulcerations from existing eroded areas on the skin surface with subsequent possibility of bacteremia; 3) compromising of tactile hairs as sensory structures; and 4) development of bronchitis or pneumonia as the result of inhaled irritants. Fouling of the baleen plates by oil can decrease their filtering efficiency (Braithwaite et al., 1983) and result in oil ingestion that could lead to blockage of the narrow channel of the stomach (Albert, 1981). However, the extent of oiling that would be necessary to produce these effects is unknown. Recent experiments, summarized by Geraci and St. Aubin (1982, 1985, 1986), demonstrate that effects of actual oiling of certain marine mammals can be short-term, transient, minor, and reversible.

Geraci and St. Aubin (1986) reasoned that bowhead whales have the visual capability to detect spilled oil, which sufficiently alters the optical properties of the surface, and may also be able to detect oil by tactile senses. Cetaceans may be initially attracted to an oil slick but may subsequently learn to avoid them. Such behaviors, as displayed in dolphin studies, may help individuals avoid multiple contacts with oil. They acknowledge, however, that in heavy ice conditions, the ability of bowhead whales to avoid oil trapped among ice would be limited. Observations from the Regal Sword spill off Cape Cod (Goodale et al., 1982), show that large whales (i.e., fin, humpback, and probably right whales) did not avoid areas of oil spills, and apparently performed normal activities, such as feeding, in and among oil slicks. This may indicate that either the whales were unaware of and unable to detect the oil slicks, or were not bothered by them. Gray whales off Coal Oil Point in California showed mixed reactions to the oil seeps there (Geraci and St. Aubin, 1982). Some whales apparently avoided the area, and others modified their behavior while passing through the area. Whether this indicates detection and learned avoidance among individuals, or adverse reaction, is unclear. In any case, these examples indicate that whales may not readily avoid oil spills, and may, therefore, be susceptible to the effects of contact with a spill. However, no ill effects to whales have been observed in these areas.

Geraci and St. Aubin (1986) demonstrated that the skin of toothed whales and dolphins is at least partially resistant to oil, and subtle effects caused by short-term contact with volatile components are reversible. They believe the structure of the skin of bowhead whales should afford at least equal protection. However, the questions of efficacy of adherence of oil to the skin and the effects of long-term exposure to persistent oil remain unanswered. Albert (1982) suspects that the skin erosions on bowheads will facilitate adherence while Geraci and St. Aubin

(1986) believe that unless whales are trapped in a lead and remain in continuous contact with newly spilled oil for a period of hours or days, petroleum hydrocarbons would have little effect on the intact epidermis of whales.

Petroleum vapors, particularly the low molecular weight hydrocarbons, inhaled within a few hours of being spilled can be toxic. Evaporation rapidly removes these components from oil and they are the first to disperse into the air. Evaporation would be slowed in the cold Arctic waters, possibly lessening the spread of harmful concentrations of toxic vapors. Inhaled volatile hydrocarbons may aggravate lung diseases or be absorbed into the circulatory system and liver. Bowhead whales encountering a weathered oil spill in open water would not be exposed to harmful vapors (Geraci and St. Aubin, 1986).

Although bowhead whales may feed on contaminated prey, it would appear to be difficult for them to consume enough oil in this manner to be toxic from absorbed hydrocarbons. As in humans, they could develop lung damage from aspirating regurgitated hydrocarbons (Geraci and St. Aubin, 1986).

Bowhead whales rely on ice leads, cracks and small pools during their spring migration. Cracks and small pools are likely to concentrate spilled oil entering the water. Bowheads, in a lead system, may be unable to avoid encounters with oil in cracks and small pools, and, therefore, would be more susceptible to oil contact than would whales in open water.

Hansen (1985) reviewed the literature on the potential effects of oil spills on whales and other marine mammals, and offered that the level of effect would be related to the degree of exposure of a cetacean to an oil spill. Baleen whales, such as the bowhead, may be less likely to avoid oil slicks than more mobile small cetaceans, and the bowheads' association with sea-ice may also provide less ability or opportunity for avoidance than for subarctic species (Geraci and St. Aubin, 1986).

Other effects of oil spills to bowhead whales would most likely be through reductions in availability of their plankton food supply within localized areas near the spill site and in areas where the oil slick occurred. In addition there may be uncertain long-term effects of oil ingestion and hydrocarbon accumulation.

Noise Disturbance: Potential impacts to bowhead whales that may result from noise disturbance include disruption of feeding activity, short or long-term displacement or deviations from migratory paths, interference with socialization, reproductive behavior and communication, physiological stress, and abandonment of traditional use areas. Geophysical seismic noise, particularly from airgun arrays used in conducting deep seismic surveys, as well as drilling, construction, icebreaker activity, and other vessel noise in areas where whales are present could cause such impacts. The range or level of noise required to produce these effects depends on the ambient noise levels, the source level of noise, and the acoustic propagation properties of the environment.

...y of the sounds produced by industrial activities are at low frequencies (below 1000 Hz), which is also the frequency range of ıst bowhead vocalizations. Because the proposed Sale 97 lease rea is seaward of the barrier islands, such low frequency noises ould travel long distances to waters used by bowhead whales for igration and feeding in spring and fall.

To date, there has been little opportunity to directly assess the mpacts of industrial activities on bowhead whales in Alaska ıters. This relates primarily to the fact that most prior OCS :tivities in Alaska waters (all of which are still in the xploration phase) have occurred during the winter when bowhead vhales are not present. During the spring, the ice leads used by the migrating whales are well offshore and away from any gravel islands where most wells have been drilled to date, and exploratory drilling in the spring lead systems is not expected as a result of this lease sale. Exploration at few drilling locations has recently been permitted during the fall migration. Most of these locations have also been shoreward of the main migration corridor. In 1985, Unocal Exploration was allowed to conduct above threshold drilling during the fall whale migration from the first drillship operation in the Alaskan Beaufort Sea. Although the well location was in the nearshore migration corridor, the drilling was completed before the onset of the fall migration. Drilling of a second nearby well in 1985 by Shell Western was prevented by heavy pack ice. In 1986, Shell Western was permitted to conduct exploratory drilling during the beginning of the fall migration, and Unocal subsequently drilled a well, also during the migration. Each well used a drillship, an icebreaker and icebreaking support vessels, and the well locations were in the nearshore migration path of the bowhead whale. Studies were conducted to determine the effects of noise on the migrating whales (LGL, 1986). Results of these studies are not yet available.

In an MMS-contracted, 2-year study of noise characteristics and propagation, the underwater acoustic environments of six specific drill sites in the Alaskan Beaufort Sea were measured during 1985 and 1986. This information was used to develop preliminary estimates of zones of responsiveness of bowheads to these noise sources. Based on preliminary (1985) results, the zones of potential responsiveness (where half of the whales would probably respond at a 30db signal to noise ratio) are estimated through modeling studies to extend 1.5 to 7.4 km from a dredge noise, 2.7 to 13 km for a tug noise, 1.3 to 6.5 km from drillship noise, and 0.02 to 0.7 km from man-made gravel island drilling noise (Miles et al., 1986). A small proportion of whales would probably respond at an estimated 6 to 22 km from a dredge, 11 to 30 km from a tug, 6 to 19 km from a drillship and 0.1 to 1.7 km from gravel island drilling.

Disturbance responses of bowhead whales to industrial activities have been the focus of a 5-year study in the Canadian Beaufort Sea during the summer seasons (Richardson, 1981, 1982, 1983; Richardson et al., 1985a-c). Sources of noise included geophysical seismic exploration, drilling and associated machinery noise, dredging, icebreaker activity, boat and aircraft traffic, and construction of gravel islands or other offshore structures. Behavior near actual and simulated activities associated with offshore oil exploration was compared with presumably undisturbed behavior. In general, bowheads showed considerable tolerence of ongoing noise from dredging or drilling, but tended to react more strongly to a moving or rapidly changing situation such as an approaching boat or aircraft or a brief playback experiment (Richardson et al., 1985 a-c).

In the Canadian Beaufort studies, behavioral responses of bowheads were not apparent beyond 4 km from an active drillship. However, playback experiments showed that some bowheads reacted, although not strongly, to drillship noises at intensities similar to those 12 km from an active drillship (Richardson et al., 1985 a-c). Why bowheads reacted more strongly to playback noises than to actual noises is not clear. Richardson speculated that the more rapidly increasing noise level of the playback is perceived differently than the slower increase that a whale would experience as it swam toward a drillship. Richardson concluded that sightings near drillships and the limited reactions to playbacks show that at least some bowheads summering in the Canadian Beaufort tolerate considerable drillship noise. Whether this holds true for migrating whales in Alaska is not certain.

Playback of dredge noise in Canadian waters produced behavioral responses from bowheads, including avoidance and changes in orientation, out to 2.25 km. Around active dredges, apparently undisturbed bowheads were observed, within 1 to 5 km, and no disturbed behavior was observed beyond 2.8 km. The obvious response to some playbacks despite the tolerance of similar levels of noise from actual dredging may be related to the rapid increase of the drilling noise playbacks. However, there are variations in reactions of bowheads to dredge noise. The whales seen near actual dredges may have been less sensitive animals; those that were more sensitive may have moved away earlier or may have avoided the area (Richardson et al., 1985 a-c).

Marine geophysical sounds from seismic surveys are the loudest industrial sounds emitted into the environment. According to MMS, these activities are primarily prelease activities, and none are expected to occur as a result of Lease Sale 97 and, therefore, the potential impacts are not considered in this opinion. Deep seismic surveys are a pre-lease activity evaluated in previous biological opinions.

Heavy boat and aircraft traffic could also affect bowhead whales adversely. In the Canadian Beaufort Sea, responses of bowheads to moving boats is the most consistent and second-most pronounced of all disturbance factors tested (Montague, 1985). In most cases, bowhead whales oriented away from a moving vessel up to 4 km away and actively swam away from vessels 2 km or less away. There was no clear relationship between the size of the vessel and the distance of the response (Richardson, 1982; Richardson et al., 1985a). The whales ceased their avoidance when the vessel passed out of range, but may have remained scattered for longer periods. Collisions between vessels and bowhead whales are unlikely if the whales are able to detect and avoid the vessels' course, or if the vessels take appropriate steps to avoid the whales.

The reaction of bowhead whales to aircraft is more variable than to vessel noise. Most reactions to fixed-wing aircraft occur at flight altitudes of less than 1,500 feet (Richardson et al., 1985a). Reaction to helicopters may have a similar radius of influence (M. Dahlheim, NMFS, pers. comm.). Disturbance due to aircraft traffic, unless sustained and intense, is likely to cause only temporary disturbance to these whales. With proper altitude observance, most impacts from aircraft can be avoided.

Significant noise producing activities, such as drilling and vessel traffic, in the spring lead systems used by bowhead whales have a high potential of significantly affecting the whales. Because the migrating bowhead whales are concentrated within the lead systems in the spring, the noise could seriously disrupt the migration. However, according to MMS, exploratory activities within the spring lead systems are not expected during the bowhead migration since the ice at this time of year typically would be too thick for drilling and supply vessels to operate. Marine exploration activities generally occur for about 90 days, in August, September and October.

Additional Impacts: To date, the exposure of bowhead whales to the effects of OCS activities has largely been confined to the Canadian Beaufort Sea. In Alaska waters, limited drilling during the fall migration of the whales has only recently begun. The effects from this sale are limited to additional exploratory drilling, to the increase in permitted traffic and support activities, and to the extremely small increased risk of an oil spill occurring prior to or during the migration period. Past drilling has been restricted by lease stipulation to avoid or reduce its coinciding with bowhead whale presence during the fall migration. By limiting OCS exploratory drilling to the times of years and portions of the lease area where whales are not present, MMS has helped to avoid possible impacts from previous lease sales.

The ability of the bowhead whale to accommodate increasing industrial disturbance is uncertain. Some accommodation undoubtedly can occur, but the level of stress imposed on the

species as a result cannot be predicted. A decreased use by bowhead whales of the Canadian Beaufort Sea industrial areas, as evidenced from aerial surveys during the summer, has been noted (Richardson et al., 1985 a-c). One suggested cause for the decreased use is the effect of increased disturbance from industrial activity that began in the early 1970's and significantly increased since 1980. This hypothesis is being investigated, as is an alternative hypothesis that variation in whale abundance is related to changes in food supply availability associated with the MacKenzie River outflow.

OCS exploratory and development activities throughout the Beaufort Sea, together with similar present and proposed activities in other lease areas (Norton Sound, Navarin Basin, Chukchi Sea), may eventually adversely affect the successful life cycle of this species. At present, we are unable to predict what these tolerance thresholds might be, but do not believe that the combined effects of this sale with ongoing activities and cumulative effects should exceed this level of concern. Continued efforts to monitor distribution patterns and indicators of population health, such as reproductive success, recruitment, growth rates and behavior are necessary to assure that the combined effects from all OCS activities are not likely to jeopardize the continued existence of the bowhead whale population.

Conclusions:

We conclude that right, fin, sei, or humpback whales are unlikely to be jeopardized by the proposed exploratory activities. These whales are unlikely to be present in the proposed lease sale area. We also conclude that the proposed activities are not likely to jeopardize the continued existence of the gray whale population. Only a small segment of the population, in the northern part of its summer range, is expected to be present in the proposed lease area. Most gray whales normally summer south of the lease area in the northern Bering and southern Chukchi Seas.

Based on information provided by MMS (see Attachment 1), an uncontrolled oil blowout or a major oil spill in the proposed Beaufort Sea lease offering area as a result of exploratory drilling is an unlikely event. Therefore, we conclude that exploratory drilling itself is not likely to jeopardize the continued existence of the endangered bowhead whale.

Large or widespread noise disturbance along the migration path or in feeding areas could seriously affect bowhead whales by interfering with successful feeding, migration, or essential activities including mating, nursing, and cow/calf bonding. The range or level of noise required to produce these effects depends on the source of noise and acoustic propagation properties of the environment. Although some impacts to individuals may occur, we do not believe that the proposed activities will produce noise levels that would be expected to reduce appreciably the likelihood of the survival and recovery of the bowhead whale by reducing the reproduction, numbers or distribution of the species. Therefore, we conclude that the leasing and exploration associated with L.S. 97 is not likely to jeopardize the continued existence of the bowhead whale.

Although individual impacts may occur, we believe the foreseeable exploratory activities in this area are unlikely to produce a level of physical impacts, such as collisions with vessels or structures, that are likely to jeopardize the species.

This opinion is based on the best available information, including noise-effects studies on bowhead whales summering in the Canadian Beaufort Sea. NMFS believes that continued monitoring of bowhead whale migrations at industrial sites is necessary to detect any major disturbance. Results from monitoring studies and other additional information would be helpful in future consultation on OCS activities, particularly those associated with development and production. Conservation Recommendations addressing research needs and additional actions that MMS and/or the oil companies can take to minimize adverse effects to bowhead whales are provided with this opinion.

Reinitiation of Consultation:

During the post-lease exploration phase, MMS should provide NMFS with all exploration plans and any subsequent revisions of these plans. MMS should review these plans to determine if further Section 7 Consultation is necessary during exploration. Consultation must be reinitiated for the development and production phases in the Beaufort Sea. Consultation must also be reinitiated if (1) new information reveals impacts from the proposed activities that were not previously considered, (2) the activities are modified in a manner that causes effects that were not previously considered, or (3) a new species is listed or critical habitat is designated that may be affected by the proposed activities.

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INCREMENTAL STEP CONSULTATION

The preceding opinion covers the incremental step of leasing and exploration of L.S. 97. In addition to our opinion on the incremental step (leasing and exploration), NMFS is providing its views on the entire action including development and production. For the Federal agency to proceed with the incremental step, there must be a reasonable likelihood that the entire action will not violate Section 7(a)(2) of the ESA (50 CFR §402.14(k)). Based on currently available information and technology and the absence of effective mitigating measures, NMFS believes that development and production activities in the spring lead systems used by bowhead whales (in the western part of the lease sale area along the Chukchi Sea coast and extending to the northeast of Pt. Barrow) would likely jeopardize the continued existence of the bowhead whale population. NMFS will reconsider this conclusion when new information, technology and/or measures becomes available or are proposed that would effectively eliminate or otherwise mitigate this potential jeopardy situation.

At this time, we are unable to foresee how potential year-round development and production activities, if oil is found, can be timed or conducted to avoid potential impacts to these whales. We base this belief on our present knowledge of the confined nature of the spring lead system used by migrating bowhead whales and our concerns for the risks from spilled oil and noise disturbance in the leads. We believe that significant noise-producing activities in the pathway of the spring migration could block or seriously disrupt the successful movements of the species into the Beaufort Sea. Since we do not have any information concerning the effects of noise on bowheads in the lead systems and only limited information on the effects of noise on migrating whales, we are unable at this time to define the levels of noise necessary to produce these effects. We also believe that the more likely risk of oil spills during production is particularly critical in the spring leads. MMS projects an 82 percent chance of one or more 1,000 or more barrel oil spills occuring over a 30-year period in the proposed sale area if all resources found are produced.

We believe the potential for jeopardy must be recognized during the leasing stage. Therefore, NMFS provides the following reasonable and prudent alternatives that MMS can adopt to avoid the likelihood of jeopardy. We believe that either (1) the lease blocks within 25 miles of the nearshore lead system (including a 25 mile radius of Pt. Barrow) should be deferred from the lease sale, which this is similar to the Barrow Deferral Area identified by MMS during consultation (see Figure 1) or, (2) if leasing and exploration occur in these areas, development and production activities should not be approved in these blocks

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unless further consultation results in a no jeopardy conclusion. Specific options and alternatives may be developed during further consultation, particularly as new information or technology is developed or specific development plans or specific mitigation measures are proposed. However, we cannot, at this time, identify more specific reasonable and prudent alternatives to offer MMS to avoid this likelihood of jeopardy.

INCIDENTAL TAKE STATEMENT

Section 7(b)(4)(C) of the ESA specifies that in order to provide an incidental take statement for an endangered or threatened species of marine mammal, the taking must be authorized under Section 101(a)(5) of the Marine Mammal Protection Act of 1972 (MMPA). Since no taking incidental to the proposed activity has been requested or authorized under Section 101(a)(5) of the MMPA, no statement on incidental take of endangered or threatened marine mammals is provided, and no take is authorized.

CONSERVATION RECOMMENDATIONS

NMFS offers MMS the following recommendations to further promote the conservation of endangered whales:

1. To avoid adverse effects should a major oil spill occur, MMS should use its authorities to keep the areas occupied by these whales free of spilled oil when bowhead whales are present. Special precautions should be taken in the following areas to ensure that spilled oil does not persist at the given times: a) Areas located in or near lead systems used by bowhead whales during their spring migration (April through June). In the Chukchi Sea, this includes the nearshore area from Wainwright to Pt. Barrow. In the Beaufort Sea, this includes the nearshore area north and east of Pt. Barrow and the shear zone and lead systems that widen as they extend eastward and farther offshore toward the eastern part of the lease offering area; b) The coastal migratory corridor in the fall (August through October), from the U.S./Canada Border to the western boundary of the lease area, particularly the waters between the 20 to 50 m isobaths during the nearshore migration in September-October; and c) Those feeding areas used in the fall between the U.S./Canada Border and Barter Island, offshore of Camden Bay-Flaxman Island, off the Colville River (outer Harrison Bay), and the nearshore waters from Smith Bay to Pt. Barrow.

2. MMS, with the assistance of NMFS, should establish measures to reduce, as far as practicable, possible impacts from noise associated with drilling and other activities. During the spring (April through June) and fall (August through October), drilling, construction, and vessel traffic should not be conducted in a manner that will significantly affect any whales present. Specific measures to reduce impacts of drilling and associated activities at individual well locations cannot be specified until these locations are known and exploration plans are submitted. Case-by-case information on the location, times, and manner of drilling operations, along with planned mitigating measures to protect bowhead whales, should be provided to NMFS for review.

3. If drilling or other downhole activities are to occur during the fall migration, the fall migration should be monitored using aerial or other appropriate survey techniques to determine when whales are present. Behavioral monitoring of the whales should be conducted by qualified researchers to determine if the whales are being affected. In addition, the number of active sites should be limited to decrease the potential for adverse effects. If bowhead whales display more than negligible adverse effects as a result of these activities, MMS should order the activities to cease immediately.

4. To minimize harassment to bowhead or other endangered whales from daily activities associated with OCS exploration in the Beaufort and Chukchi Seas, aircraft should observe a minimum distance of 1,500 feet (approximately 500 m), horizontally or vertically from observed whales, and from areas where whales are believed to be present. Vessels should avoid concentrations of whales and attempt to keep a distance of at least one mile from any observed whales.

5. MMS should continue to sponsor research needed to improve knowledge of the seasonal movements and habitat utilization of endangered whales in the Beaufort and Chukchi Seas, and of the effects of oil spills and other OCS activities on these whales. Possible areas of continued research are a) to identify and characterize feeding areas, and determine their importance to bowhead whales; b) to understand the nature and effects of industrial noise on whales, including geophysical seismic sounds using airguns, drilling noise from both fixed and floating units and their support activities, including icebreakers and dredges, c) to determine the behavioral responses of bowheads to these different industrial noise sources with varying range; and d) to detect cumulative effects.

6. Information on the location of the spring lead system and distribution of bowhead whales in this system is partially available from aerial surveys and spring whale census efforts. This information should be thoroughly analyzed to determine the precise location, extent, and variation of this migratory corridor so that this information can be used in future leasing decisions in the western lease area. Certain information gaps remain on the variability in location of these nearshore leads in the Chukchi Sea, distribution of the whale migration across the lead system, and the extent of the leads' integrity as one system after passing Pt. Barrow.

7. The results of MMS sponsored research on bowheads and other endangered whales should be made available to NMFS and other agencies involved with managing these species as soon as possible after completion of the research. To provide for greater interdisciplinary coordination among researchers, and between researchers and agencies, annual research coordination and review workshops are helpful to update information and study results on the bowhead and other endangered whales.

8. The Beaufort Sea Biological Task Force should also be used for this lease sale to assist MMS in ensuring that OCS operations are planned and conducted in a manner to protect and conserve endangered species and other living marine resources and the habitats upon which these resources depend.

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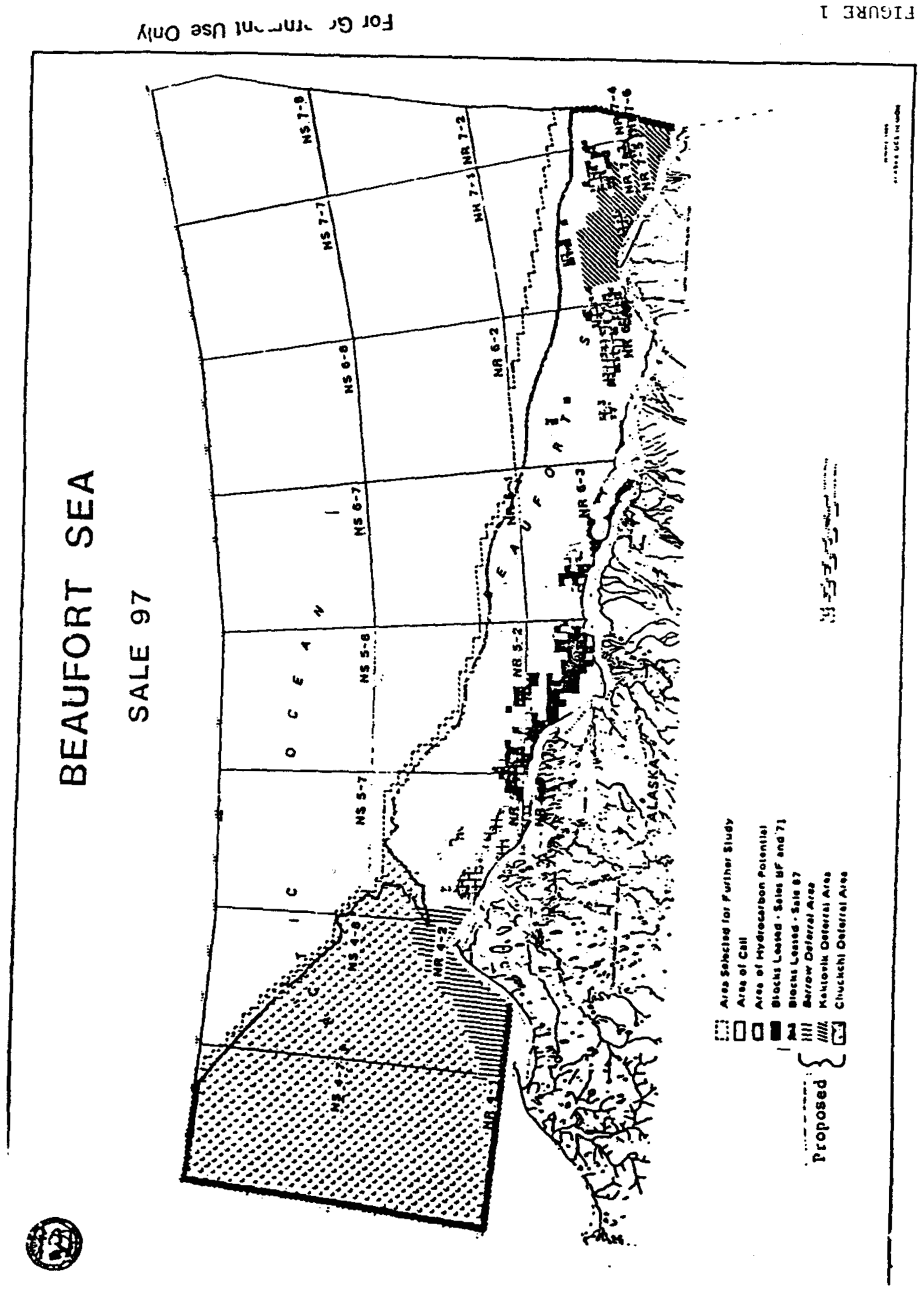

Ninety-ninth Congress of the United States of Amer...

AT THE SECOND SESSION

Begun and held at the City of Washington on Tuesday, the twenty-first day of January, one thousand nine hundred and eighty-six

SIGNED
11-14-86

An Act

To amend certain provisions of the law regarding the fisheries of the United States, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—FISHERIES CONSERVATION AND MANAGEMENT

SEC. 101. UNITED STATES RIGHTS AND AUTHORITY REGARDING FISH AND FISHERY RESOURCES WITHIN THE EXCLUSIVE ECONOMIC ZONE.

(a) DEFINITION OF EXCLUSIVE ECONOMIC ZONE.—Section 3 of the Magnuson Fishery Conservation and Management Act (hereinafter in this title referred to as the "Act") (16 U.S.C. 1802) is amended—

(1) by striking out paragraph (8);

(2) by redesignating paragraphs (6) and (7) as paragraphs (7) and (8), respectively; and

(3) by inserting immediately after paragraph (5) the following new paragraph:

"(6) The term 'exclusive economic zone' means the zone established by Proclamation Numbered 5030, dated March 10, 1983. For purposes of applying this Act, the inner boundary of that zone is a line coterminous with the seaward boundary of each of the coastal States.".

(b) AUTHORITY REGARDING EXCLUSIVE ECONOMIC ZONE.—Title I of the Act (16 U.S.C. 1811-1813) is amended to read as follows:

"TITLE I—UNITED STATES RIGHTS AND AUTHORITY REGARDING FISH AND FISHERY RESOURCES

"SEC. 101. UNITED STATES SOVEREIGN RIGHTS TO FISH AND FISHERY MANAGEMENT AUTHORITY.

"(a) IN THE EXCLUSIVE ECONOMIC ZONE.—Except as provided in section 102, the United States claims, and will exercise in the manner provided for in this Act, sovereign rights and exclusive fishery management authority over all fish, and all Continental Shelf fishery resources, within the exclusive economic zone.

"(b) BEYOND THE EXCLUSIVE ECONOMIC ZONE.—The United States claims, and will exercise in the manner provided for in this Act, exclusive fishery management authority over the following:

"(1) All anadromous species throughout the migratory range of each such species beyond the exclusive economic zone; except that that management authority does not extend to any such species during the time they are found within any foreign nation's territorial sea or exclusive economic zone (or the

Coast Guard and Koniag, Incorporated, and includes the right to construct and operate an access road, bridges, guard rails, and other associated improvements; and

(B) a 40-foot wide utility easement adjacent to the access easement in paragraph (3)(A) of this subsection or a location that is mutually agreeable to the Coast Guard and Koniag, Incorporated.

(4) The construction, maintenance, and operation of a dock facility or location of any structure or thing on the premises described in section (c) of Schedule 4 of the Agreement is not inconsistent with the easement for the barge landing easement and access to and from the barge landing area reserved by the United States Government (hereinafter referred to in this paragraph as the "Government"), if the dock facility is constructed or the structure or thing is located as approved by the Government. Approval by the Government is deemed to be granted if a proposal for the construction and location of the dock facility, structure, or thing is submitted to the Government and—

(A) the Government does not respond within 60 days of receipt of the proposal; or

(B) if a response with recommendations for modification is submitted by the Government within 60 days of receipt of the proposal, the proposal is modified in a manner necessary to reasonably satisfy the requirements of the Government—

(i) to use the dock facility for a barge landing area as contemplated by the easement; and

(ii) to permit access to and from the barge loading area to public highways for the transportation of materials as specified in Agreement.

(b) APPLICATION.—All rights or conveyances confirmed by this section are subject to the sanctions in the Agreement referred to in subsection (a).

(c) IMPLEMENTATION.—The Commandant of the Coast Guard or other appropriate Federal officer shall issue the appropriate corrective conveyance and perform any other appropriate ministerial or official act necessary to carry out the purposes of this section within 60 days after the date of the enactment of this title.

SEC. 411. INCIDENTAL TAKING OF DEPLETED MARINE MAMMALS.

(a) AMENDMENT OF THE MARINE MAMMAL PROTECTION ACT.—Paragraph (5)(A) of section 101(a) of the Marine Mammal Protection Act of 1972 (16 U.S.C. 1371(a)(5)(A)) is amended—

(1) by striking "that is not depleted";

(2) in clause (i)—

(A) by striking "its habitat, and" and inserting in lieu thereof "will not have an unmitigable adverse impact"; and

(B) by inserting "or, in the case of a cooperative agreement under both this Act and the Whaling Convention Act of 1949 (16 U.S.C. 916 et seq.), pursuant to section 112(c)" immediately after "or section 109(f)"; and

(3) in clause (ii)(I), by inserting ", and on the availability of such species or stock for subsistence uses" immediately after "significance".

(b) STATEMENT BY THE SECRETARY.—Paragraph 4 of section 7(b) of the Endangered Species Act of 1973 (16 U.S.C. 1536(b)(4)) is amended—

(1) by striking "and" at the end of subparagraph (A);

(2) by inserting "and" after the semicolon at the end of subparagraph (B); and

(3) by inserting after subparagraph (B) the following subparagraph:

"(C) if an endangered species or threatened species of a marine mammal is involved, the taking is authorized pursuant to section 101(a)(5) of the Marine Mammal Protection Act of 1972;";

(4) by striking "and" at the end of clause (ii);

(5) by redesignating clause (iii) as clause (iv) and by striking "clause (ii)" in that clause and inserting in lieu thereof "clauses (ii) and (iii)"; and

(6) by inserting after clause (ii) the following new clause:

"(iii) in the case of marine mammals, specifies those measures that are necessary to comply with section 101(a)(5) of the Marine Mammal Protection Act of 1972 with regard to such taking, and".

(c) EXEMPTIONS.—Subsection (o) of section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1536(o)) is amended—

(1) in the matter preceding paragraph (1)—

(A) by inserting ", sections 101 and 102 of the Marine Mammal Protection Act of 1972," immediately before "or any regulation"; and

(B) by striking "either" and inserting in lieu thereof "any"; and

(2) in paragraph (2)—

(A) by striking "(b)(4)(iii)" and inserting in lieu thereof "(b)(4)(iv)"; and

(B) by inserting "prohibited" immediately before "taking of the species".

Speaker of the House of Representatives.

Vice President of the United States and President of the Senate.

electromagnetic interference with the Coast Guard's Holiday Beach receiver site or is operated or maintained under terms and conditions mutually agreeable to the Coast Guard and Koniag. If harmful electromagnetic interference is discovered, the Coast Guard would have the authority to halt the activity.

~~Section 511~~ PASSED AS SECTION 411

This section amends the Marine Mammal Protection Act (MMPA) and makes conforming amendments to the Endangered Species Act (ESA) to allow incidental taking of depleted as well as non-depleted species of marine mammals under certain conditions.

The 1982 amendments of the ESA contained a provision that allowed the incidental take of listed species if the result of the consultation process was a non-jeopardy biological opinion or the specification of reasonable and prudent alternatives, and if the parties concerned took actions to minimize and mitigate the taking. The 1981 amendments of the MMPA contained provisions that allowed similar incidental taking of non-depleted marine mammals. Since species listed as threatened as endangered under the ESA are considered depleted under the MMPA and the more restrictive provisions of the MMPA prevail, the ESA provisions could not be used to authorize incidental taking of depleted marine mammals, even if the take involved was non-lethal and resulted in no jeopardy.

The provisions of this section would amend section 101(a)(5)(A) of the MMPA to allow incidental taking of depleted species of marine mammals under certain conditions and would

amend the ESA to clarify that such taking must satisfy section 101(a)(5)(A) as so amended.

The combined provisions of the ESA and the "negligible impact" standard of the MMPA should secure effective protection for such listed marine mammals.

Subsection (a) deletes the phrase "that is not depleted" from section 101(a)(5)(A) of the MMPA, thereby allowing the incidental taking of depleted marine mammals pursuant to the same statutory requirements as are applied to the incidental taking of non-depleted species. It is intended that the new statutory standards applied by the Secretary regarding depleted species be the same as those for non-depleted species. In order that there be no confusion as to the interpretation of the standard now applicable to incidental taking of both depleted and non-depleted species, it is explained below.

It is intended that the term "negligible impact" as contained in subparagraph (5)(A)(i) of the MMPA be determined with reference to the affected population of marine mammals, and not with reference to the effects on individual members of any population, unless the resulting impact on the populations is more than negligible. For instance, an individual whale might be affected by industrial activities so as to alter its course but that would likely result in a negligible impact on the individual and the population absent some other adverse impact. On the other hand, effects on individuals could result in a greater than negligible impact on the population depending on the number of individuals affected in proportion to the total population or the severity of the effect on each individual.

The term "negligible impact" as applied to populations means an impact that cannot reasonably be expected to, and is not reasonably likely to affect adversely the overall population through effects on annual rates of recruitment or survival. It is not intended that the Secretary find impacts to be more than negligible when the effect of specified activities on the population is conjectural or speculative. Impacts which are not negligible must be attributable to the action being considered. The degree of certainty of occurrence required in these judgments should be inversely proportional to the resultant harm to the overall population.

It is intended that if the Secretary finds that mitigating measures would render the impact of a proposed activity negligible when it would not otherwise satisfy that requirement, the Secretary shall require such measures by regulation under subparagraph (5)(A)(ii) as a condition of the authorization for any such incidental taking.

A minor impact upon a small segment of habitat might be found to be more than negligible under the prior standard, even if it had no impact upon the overall population utilizing the habitat. But it is also the case that populations could be affected adversely by actions that damage rookeries, mating grounds, feeding areas and areas of similar significance. The Secretary shall take those impacts into account when making a "negligible impact" determination under section 105(A)(5)(i).

Because these factors are to be taken into account in making such a determination, subparagraph (a)(2)(A) of this section deletes the phrase "and its habitat" from subparagraph 5(A)(i) of the MMPA. It is expected that the existing provisions of the ESA relating to protection of critical habitat will secure adequate protection of any habitat so designated. Moreover, the provisions of subparagraph (5)(A)(ii) of the MMPA ensure the least practicable adverse impact upon the species' habitat, even if it is not designated as critical habitat and even if the impact of the activities on the population will be negligible.

Subsection (a) also modifies the standard by which the Secretary is to evaluate the impact on subsistence uses, in effect substituting "unmitigable adverse impact" for "negligible." This is a more workable and effective standard.

An "unmitigable adverse impact" in this context is one that is attributable to the particular activities resulting from the agency action being considered as opposed to environmental or other extraneous factors, and is likely to result in a reduction in availability of marine mammals to a level insufficient to allow for a harvest of resources sufficient to meet the subsistence needs of the community for marine mammals by: (1) causing sufficient numbers of the marine mammal population subject to subsistence use to vacate subsistence hunting areas; or (2) directly displacing subsistence users; or (3) erecting physical barriers between the marine mammals and the subsistence hunters. In addition, such an impact must also be one which cannot be sufficiently mitigated to increase that availability such that a harvest which meets the subsistence needs of the community may be obtained. It is not intended that this section affect the interpretation of any other laws relating to subsistence uses, rights, obligations or responsibilities.

The reference to "a cooperative agreement" in subparagraph (a)(2)(B) is intended to cover cooperative agreements such as the one entered between NOAA and the Alaska Eskimo Whaling Commission under both the Whaling Convention Act of 1949 and the MMPA.

It is further intended that protection of the marine mammals and availability of the marine mammals for subsistence use be secured by regulations under subparagraph (5)(A)(ii) of the MMPA. Subparagraph (a)(3)(B) amends subparagraph (5)(A)(ii)(I) of the MMPA to require that regulations be issued to ensure the least practicable adverse impact on such subsistence use even if the activity will not otherwise have an unmitigable adverse effect. Mitigating measures are intended to facilitate the harvest of sufficient resources to meet subsistence needs of the community and to minimize the impacts upon subsistence species and users. The agency or applicant and affected subsistence users are encouraged to agree upon terms and conditions for activities which satisfy the operational, scientific, or other needs of the agency or applicant and the requirements of the subsistence users. Applicants are also encouraged to meet directly with

subsistence users to develop agreements for specific activities which may have an impact on the availability of marine mammals taken for subsistence uses.

It is intended that the Secretary amend the general regulations (50 C.F.R. 228.1 - 228.6) to implement the amended section 101(a)(5)(A) of the MMPA as it applies to depleted marine mammals in accordance with the legislative intent as contained in this document and the changes brought about by these amendments. It is anticipated, however, that new species-specific regulations would be required by section 101(a)(5)(A)(ii) of the MMPA for specified activities in a specified region involving incidental taking of a depleted species.

It is intended that, immediately upon passage of this legislation and subject to the provisions of other applicable law including the ESA, the Secretary may provide for incidental taking of depleted species under the MMPA by promulgating regulations required by section 101(a)(5)(A)(ii) and issuing letters of authorization through procedures described for incidental taking of non-depleted species in current regulations (50 C.F.R. Part 228). The new regulations and letters of authorization should be patterned after the current regulations for incidental taking of non-depleted ringed seals (50 C.F.R. 228.11 - 228.14) with necessary modifications to conform to these new provisions and the legislative intent expressed in this document.

Finally, subsections (b) and (c) make conforming amendments to the ESA to reflect the changes to the MMPA and to clarify the relationship between the two statutes. It is intended that the decision processes under the involved statutes be coordinated and integrated to the maximum extent practicable.

Section 512

This section contains provisions ordered reported unanimously by the Commerce Committee on September 24, 1986. It grants legislative waivers from restrictions on vessel documentation under the laws of the United States for five vessels:

(1) DUNES SPIRIT

The Committee approved a Jones Act waiver for the DUNES SPIRIT (U.S. official number 690176) because of the need to correct a questionable action by the Coast Guard regarding this particular vessel. This 45-foot sailboat, which is 49 gross tons and was built overseas, was purchased new from a New Jersey boat dealer in 1985. It is capable of carrying up to 24 passengers with a two-person crew. The buyer, a real estate company from Hilton Head Island, South Carolina, purchased this vessel for the exclusive recreational use of time-share owners of a condominium project at Shelter Cove Harbour on Hilton Head. From August to November 1985, the time-share owners of the condominium development chartered the vessel on a bareboat basis for four days each week. Under terms of the August 1985 agreement, it is clear that the

ATTACHMENT 1

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
WASHINGTON, DC 20240

In Reply Refer To:
LMS-Mail Stop 644

NOV 1986

NATIONAL MARINE FISHERIES SERVICE
NOV 28 1986
CORRESPONDENCE CONTROL U...

Dr. William E. Evans
Assistant Administrator for Fisheries
National Marine Fisheries Service
Department of Commerce
Washington, D.C. 20235

Dear Dr. Evans:

The Minerals Management Service (MMS) is currently awaiting Endangered Species Act section 7 biological opinions from the National Marine Fisheries Service (NMFS) for Alaskan Outer Continental Shelf (OCS) Oil and Gas Lease Sales 97 (Beaufort Sea), 107 (Navarin Basin), and 109 (Chukchi Sea). The MMS requested formal consultations for the leasing and exploration aspects of Sale 97 on July 10, 1985; for those of Sale 107, on January 2, 1986. A June 6, 1986, consultation request letter confirmed that a consultation meeting for Sale 109 was held in Anchorage on March 25, 1986, and that the MMS believed this to be the official start date of formal consultation for leasing and exploration activities attendant that sale.

In view of the time that has elapsed since these consultations began, and because we are trying to complete environmental impact statements for which the opinions are needed, we need to know the status of the opinions and would appreciate your help in securing their timely issuance. However, we are also concerned that the opinions assess accurately and objectively the risk that potential OCS exploration-related oil spills pose to endangered whales in the Beaufort, Bering, and Chukchi Seas. The following observations indicate that it may be appropriate now to review and modify practices followed in the past.

In the NMFS draft opinions for Sales 97 and 107, which we were permitted to review earlier this year, the NMFS concluded that potential oil spills due to OCS activities during exploration would jeopardize the continued existence of bowhead whales. As we have subsequently noted, relative to these sales and specific exploration activities, the available data on oil spill risk, especially during exploration, do not warrant such a determination. Information documenting this view is contained in the enclosed summary paper. It was also included in more detailed analyses of oil spill risk presented by oil companies to the State of Alaska last winter relative to the State's review of its seasonal drilling restriction. The MMS presented it, too, in more detail to the NMFS last May relative to waiving the Federal seasonal drilling restriction in the Beaufort Sea to allow scientific research on the effects of noise on bowhead whales during their fall migration. Because this information was largely unavailable in its processed form during the early stages of the consultations and does not appear to have been factored into the draft opinions we have reviewed, we ask now that this be done.

Dr. William E. Evans 2

Furthermore, because oil spill risk bears directly on "jeopardy" conclusions in all Alaska opinions in which endangered whales are involved, we believe that the information enclosed warrants exclusion of oil-related jeopardy determinations from all three pending opinions, as well as their removal from previous opinions in which the risk of potential OCS-related oil spills during exploration was thought to be great enough to necessitate jeopardy conclusions. If the NMFS concurs with our view, oil spill-based jeopardy findings should be removed from previous opinions through appropriate amendments. We think you will agree, after examining the enclosed information, the reasons for doing so are compelling.

If you or your staff desire additional information on the oil spill issue or explanation of the enclosed summary, please let us know. Because of our need to complete preparations for Sales 97, 107, and 109 in the near future, we ask that you inform us as soon as possible about the status of these opinions and your decision regarding our suggested removal of oil spill-related jeopardy from biological opinions for Alaskan OCS sales.

Sincerely,

Wm D Bettenberg

Director

Enclosure

Enclosure

Probability of an Oil Spill from Offshore Exploratory Drilling: A Summary

An oil spill of 1,000 barrels or greater is very unlikely during exploration. The exploration spill rate for the U.S. Outer Continental Shelf (OCS) is 0.083 spills of at least 1,000 barrels per billion barrels of oil found and produced (Sale 87 Final Environmental Impact Statement (EIS)). On a per-exploration-well basis (including delineation), the projected spill rate for proposed Sale 97 for spills of 1,000 barrels or greater is 0.3 percent per well drilled (Sale 97 Draft EIS). The equivalent spill rate is 1.1 percent and 0.5 percent per well drilled for proposed Sales 107 and 109, respectively (Sales 107 and 109 Draft EIS's, in preparation). The differences in the per-well spill rate among these three sales are attributable to parallel, sale-specific differences in projected oil resources per well.

These spill rates should not be equated with the level of risk to the whales. These spill rates are unrisked; that is, they assume that the (unrisked) mean resource will be found and produced. The spill rate estimates would be lower if the probability of not finding any oil were factored into the calculation. In addition, a spill would have to occur when and where the whales were present and would have to contact the whales in order to put the whales at risk. A spill may also have to be considerably larger than 1,000 barrels to have a chance of contacting an appreciable number of whales. Factoring in the probability of not finding oil, the probability of a spill occurring during a season when whales are present, and the probability of spilled oil contacting a whale (derived from the Minerals Management Service's (MMS's) oil spill-whale migration interaction computer model), the calculated risk of at least one bowhead whale contacting spilled oil is less than 1 percent for proposed Sales 97, 107, and 109.

As part of its testimony of April 15, 1986, to the State of Alaska on seasonal drilling restrictions in the Beaufort Sea, the Amoco Production Company included an analysis of the probability of a blowout and major oil spill resulting from exploratory drilling in the Beaufort Sea. This analysis, prepared by Dr. Frank B. Martin (Department of Applied Statistics, University of Minnesota), is the first statistical analysis devoted strictly to exploratory drilling. Other published analyses have combined exploration with development and production blowout and oil spill statistics (Gulf Research and Development Company, 1983; Dahl et al., 1983; The Futures Group, 1982).

Dr. Martin's analysis of blowouts and oil spills from exploratory drilling is different from the MMS oil spill analysis used in EIS's. The MMS calculates the probability of an oil spill and its size-based upon the volume of oil produced. Because oil is not produced from exploratory drilling, Dr. Martin selected the number of wells drilled as his exposure variable.

Dr. Martin based his analysis on MMS oil spill statistics for all U.S. OCS areas. The data indicate that 31 blowouts were reported for 4,824 exploratory wells from 1971 through 1984. He calculated the blowout rate to be 0.64 percent (31/4,824 x 100) with an upper 95 percent confidence level of 0.83 percent. He concluded that there is a 95 percent degree of confidence that the unknown probability of a blowout from exploratory drilling is less than 0.83 percent. Conversely, the unknown probability of a blowout <u>not</u> occurring from exploratory drilling is greater than 99.17 percent. The MMS data indicated that no oil had been spilled as a result of a blowout during exploratory drilling in any OCS area, including Alaska, from the inception of the OCS program through 1985. Using these data, Dr. Martin calculated that the probability of a major oil spill from exploratory drilling is zero percent with a 95 percent confidence level of 0.0004 percent.

Gulf Research and Development Company (Gulf) (1983--cited in Manadrill, 1985) evaluated the probability of blowouts from offshore wells drilled worldwide during the period 1955-1980. Unlike the Martin analysis, Gulf did not or could not distinguish between exploration and development wells. Gulf recorded 162 blowouts for 36,633 wells surveyed. The average blowout rate from this data base is 0.44 percent (162/36,633 x 100). This rate is approximately two-thirds of the value reported by Martin (1986) for exploration wells only.

Dahl et al. (1983--cited in Manadrill, 1985) evaluated the records of 11,160 offshore exploration and development wells for the period 1976-1980. A total of 46 blowouts was recorded for these wells. The average blowout rate from this data base is 0.41 percent (46/11,160 x 100). This rate is very similar to that reported by Gulf (1983).

In its study of offshore oil spills for the Bureau of Land Management, the Futures Group (1982) evaluated the number and size of oil spills resulting from various accidents including blowouts. The study of platform accidents did not distinguish between exploration and development wells. The analysis was focused on the Gulf of Mexico because of the large data base available for that area. Of the 236 accidents recorded in the Gulf of Mexico from 1964 to 1980, 79 (33.5 percent) were blowouts. Finite oil spillage exceeding 50 barrels was reported for 19 (24.1 percent) of these blowouts. No oil spillage as the result of a blowout was reported for exploratory drilling. Most blowouts consisted of gas and drilling mud. Based on data developed by the U.S. Geological Survey (USGS), during the period 1964-1980, the average blowout rate in the Gulf of Mexico was 0.25 percent (79 blowouts from 31,430 wells). Statistics compiled on the Gulf of Mexico for the same time period (1964-1980) by World Information Systems (cited in The Futures Group, 1982) indicated that the average blowout rate was 0.43 percent (134 blowouts from 31,430 wells). (The discrepancy between the findings of the USGS and the World Information Systems was probably associated with different criteria for defining blowouts, although the criteria themselves were not described.) The average value calculated from the data of World Information Systems is very close to the values reported by Gulf (1983) and Dahl et al. (1983).

Manadrill Drilling Management, Inc. (1985) reported that 293 exploration wells have been drilled on the Canadian continental shelf. Three blowouts have been reported (see below). The average blowout rate for the Canadian continental shelf is 1.024 percent (3/293 x 100). This rate is higher than the rates discussed previously. However, two of the blowouts reported occurred from drillships in the Canadian Beaufort Sea in 1976, the first year floating drilling units were used in the area. One well involved an underground water flow which later flowed water and gas to the sea floor around the casing and eventually stopped flowing. The other involved a shallow water and gas flow also around the casing and which also stopped flowing. Neither of these wells flowed oil. The flow of water to the surface was a result of poor cement around the casing. Improved cementing

procedures and different casing setting depths have been used to correct this problem, and over 20 additional wells have been drilled from drillships without further incidents of this type in the Canadian Beaufort. These incidents are significantly less severe from an operational or environmental standpoint than, for example, the Ixtoc or Santa Barbara blowouts where oil and gas under high pressure entered the well bore and escaped to the ocean and atmosphere. For comparison with other blowout statistics, the MMS believes these two events could be deleted from the Canadian blowout statistics, as they are not representative of blowout probabilities for drillship operations under current operating procedures. Accordingly, the blowout rate for offshore Canada would drop from 1.024 percent (3/293 x 100) to 0.34 percent (1/293 x 100), similar to blowout rates for operations in other offshore areas.

	Floating Ice Free	Floating Beaufort	Bottom Founded Beaufort	Ice Platform	Total
Wells	217	19	27	30	293
Blowouts	1	2	0	0	3

Catastrophic oil spills rarely result from exploratory well blowouts. As noted above, no oil has been spilled on the U.S. OCS as a result of a blowout during exploratory drilling. Podio et al. (1983) studied various characteristics of well blowouts in the Texas and Louisiana gulf coast region. Their study included both onshore and offshore wells and exploratory and development wells. The frequency of blowouts appeared to be greater offshore than onshore. The majority of blowouts in the Gulf of Mexico were gas (rather than oil) blowouts, and discharged materials were generally gas and mud (Podio et al., 1983). Offshore oil blowouts in the Gulf of Mexico were described as "very rare." The durations of 250 blowouts studied by Podio et al. (1983) were as follows:

Less than 1 day	102 blowouts (40.8 percent)
From 1 to 3 days	75 blowouts (30.0 percent)
From 4 to 30 days	60 blowouts (24.0 percent)
Longer than 30 days	13 blowouts (5.2 percent)

The most common method of well control following a blowout was through the circulation of heavy mud. Control of 259 blowouts, for which appropriate data were available, was through natural processes (bridging) in 101 (39.0 percent) of the incidents. Bridging resulted in the control of 85 (84.2 percent) of the wells controlled through natural processes. Bridging occurred in 61 of the wells in less than 3 days and in half of the wells in less than half a day. The authors caution that these rates of bridging reflect the nature of unconsolidated gulf coast sediments and should not be extrapolated as characteristic of other regions. Depletion of reservoir pressure accounted for the control of 16 (15.8 percent) of the wells controlled through natural processes.

Based upon its analysis of blowouts, Manadrill (1985) proposed that blowouts occur approximately three times more frequently during exploration than during production, regardless of the operating area. In contrast, MMS (1983) statistics indicate that during the period 1971-1982, exploratory drilling accounted for only 31.6 percent of all blowouts reported on the U.S. OCS. Production (drilling, production, workover, and completion) blowouts accounted for the remaining 68.4 percent. Production drilling accounted for only 27.8 percent of all reported blowouts. Podio et al. (1983) reported that of 228 blowouts studied in the gulf coast area, 101 (44.3 percent) occurred during "tripping in" or "tripping out." The second most frequent activity during blowouts was drilling (29.4 percent).

Two compelling points can be summarized from all these statistics: First, no oil has been discharged into the ocean as the result of a blowout during exploratory drilling in the U.S. OCS or the Canadian Beaufort. Second, currently available information indicates that the probability of a blowout during exploratory drilling on the U.S. OCS is 0.64 percent, and the upper limit of the probability of a major oil spill from the blowout of an exploratory operation is 0.0004 percent. These figures reflect statistics based on operational technologies that were in use as long as 15 years ago. We expect that modern technologies and procedures which have been developed as a result of past operations in the Arctic, especially Alaska and Canada, would reduce these probabilities further.

Besides these statistics, other considerations argue against the need to impose what amounts to excessive and unwarranted constraints on exploration activities through oil spill-related jeopardy conclusions in NMFS biological opinions. Any proposed exploration in the Beaufort, Bering, and Chukchi Seas will have to satisfy the operational requirements of the MMS. Among these requirements are those of Alaska OCS Operating Order No. 2, which includes (1) a Critical Operations and Curtailment Plan (COCP) that describes, among other items, how the operator will safely and promptly secure the well, disconnect from the wellhead, and move offsite in the event of unfavorable operating conditions or other situations, and (2) monitoring of ice, meteorological, and oceanographic conditions. The COCP is included in the lessee's exploration plan or Application for a Permit to Drill (APD) and must be approved by the MMS.

Blowout prevention equipment will be installed on each well, and pressure tested periodically. All personnel involved in drilling operations will be required to attend and pass the MMS-approved well control training program. The APD for each well outlines the operator's casing, cementing, and mud programs which are designed to effectively control anticipated formation pressures and subsurface geologic conditions. Each APD will be reviewed and approved only if it meets prescribed technical standards. The MMS will provide continuous or near-continuous inspection of all exploratory operations in these areas to ensure that all regulations, orders, lease stipulations, and conditions of approval of exploration plans, APD's, and COCP's are being fully complied with, and that no unnecessary risks are being taken by operators that could jeopardize the safety of the well or personnel, or increase potential for blowouts or oil spills.

Based on all of the above information, the MMS has concluded that the probability of an oil spill resulting from a blowout during exploratory drilling in the Beaufort, Bering, and Chukchi Seas is extremely remote.

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APPENDIX K

SUPPORTING TABLE FOR SECTION III.D.4,
RECREATION AND TOURISM RESOURCES

K

Table K-1
Sale 97 Recreation and Tourism Relative to OSRA Segments

OSRA SEG. NO.	RT ECON VALUE1/	LOW (L) HIGH (H)2/	RT NON-ECON VALUE1/	LOW (L) OR HIGH (H)2/	COMBINED RANK	TYPE OF SEG.
1	1	L	8	H	LH	II
2	1	L	7	H	LH	II
3	1	L	6	H	LH	II
4	1	L	5	L	LL	(IV)
5	1	L	4	L	LL	(IV)
6	1	L	3	L	LL	(IV)
7	1	L	2	L	LL	(IV)
8	1	L	3	L	LL	(IV)
9	1	L	4	L	LL	(IV)
10	2	L	5	L	LL	(IV)
11	1	L	6	H	LH	II
12	1	L	8	H	LH	II
13	1	L	9	H	LH	II
14	1	L	8	H	LH	II
15	1	L	7	H	LH	II
16	1	L	7	H	LH	II
17	1	L	5	L	LL	(IV)
18	2	L	6	H	LH	II
19	8	H	7	H	HH	I
20	9	H	8	H	HH	I
21	8	H	7	H	HH	I
22	1	L	9	H	LH	II
23	2	L	9	H	LH	II
24	2	L	8	H	LH	II
25	1	L	7	H	LH	II
26	1	L	5	L	LL	(IV)
27	2	L	3	L	LL	(IV)
28	3	H	2	L	HL	(III)
29	6	H	5	L	HL	(III)
30	7	H	8	H	HH	I
31	8	H	9	H	HH	I
32	7	H	8	H	HH	I
33	6	H	7	H	HH	I
34	8	H	7	H	HH	(I)
35	9	H	3	L	HL	(III)
36	8	H	2	L	HL	(III)
37	2	L	3	L	LL	(IV)
38	1	L	5	L	LL	(IV)
39	1	L	7	H	LH	II
40	1	L	8	H	LH	II
41	1	L	9	H	LH	II
42	1	L	9	H	LH	II
43	1	L	8	H	LH	II
44	1	L	5	L	LL	(IV)
45	1	L	9	H	LH	II
46	1	L	2	L	LL	(IV)
47	1	L	1	L	LL	(IV)
48	1	L	1	L	LL	(IV)
49	1	L	1	L	LL	(IV)
50	1	L	1	L	LL	(IV)
51	1	L	1	L	LL	(IV)
52	1	L	1	L	LL	(IV)
53	1	L	1	L	LL	(IV)
54	1	L	1	L	LL	(IV)
55	1	L	1	L	LL	(IV)
56	1	L	1	L	LL	(IV)
57	1	L	1	L	LL	(IV)
58	1	L	1	L	LL	(IV)
Mean	2		5			

Source: MMS, Alaska OCS Region.

1/ Economic and noneconomic factors are ranked on a scale of 1 to 10.
2/ A determination of L (Low) or H (High) is made by comparing the rank with the column Mean.
3/ The Types III and IV in parentheses()--high economic qualities with low noneconomic values and low economic values with low noneconomic values--are less related to recreation and tourism and are not discussed in detail in the EIS.

APPENDIX L

FATE AND EFFECTS OF EXPLORATORY PHASE OIL AND GAS DRILLING DISCHARGES IN THE BEAUFORT SEA PLANNING AREA, LEASE SALE 97

L.

FATE AND EFFECTS OF EXPLORATORY PHASE OIL AND GAS DRILLING DISCHARGES IN THE BEAUFORT SEA PLANNING AREA, LEASE SALE 97

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10

Developed with the assistance of:

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INTRODUCTION

One of the major permits required for the operation of oil and gas drilling facilities is a National Pollutant Discharge Elimination System (NPDES) permit under the Clean Water Act (the Act or CWA hereafter) for discharges into marine waters. Authorized discharges from oil and gas drilling operations include drilling muds and cuttings, sanitary and domestic wastewater, desalination unit discharges, boiler blowdown, uncontaminated ballast and bilge water, blowout preventer fluid, excess cement slurry, deck drainage, non-contact cooling water, fire control system test water and test fluids.

Section 301(a) of the Act provides that the discharge of pollutants is unlawful except in accordance with the terms of an NPDES permit. Under the Environmental Protection Agency's (EPA) regulations [40 CFR 122.28(a)(2)], EPA may issue a single general permit to a category of point sources located within the same geographic area if the regulated point sources:

(1) involve the same or substantially similar types of operations;

(2) discharge the same types of wastes;

(3) require the same effluent limitations or operating conditions;

(4) require similar monitoring requirements; and

(5) in the opinion of the Regional Administrator, are more appropriately controlled under a general permit than under individual permits.

In addition, under EPA regulations [40 CFR 122.28(c)(1)], the Regional Administrator is required to issue general permits covering discharges from offshore oil and gas facilities within the Region's jurisdiction. Where the offshore area includes areas for which separate permit conditions are required, such as areas of biological concern, a separate individual or general permit may be issued by the Regional Administrator.

The Agency's recent permit decisions in Alaskan OCS areas have been that exploratory oil and gas facilities are more appropriately controlled by a general permit than by individual permits. EPA expects to issue a general permit for exploratory drilling operations for Lease Sale 97.

EPA is issuing an individual permit for the first offshore oil and gas development and production operation in the Alaskan Arctic, the Endicott Development Project. This operation differs significantly from exploratory drilling operations covered by the existing general permit for the Beaufort Sea in that it entails the discharge of substantially larger quantities of drilling muds and cuttings over a period of several years. An individual permit is therefore required to impose the necessary effluent limitations and monitoring requirements for the Endicott Project. EPA, similarly, may elect to issue individual NPDES permits for future development and production operations in Lease Sale 97. This issuance of individual or general NPDES permits for future development and production operations in Sale 97 is, however, not included here as a part of EPA's proposed action.

EPA anticipates promulgating New Source Performance Standards (NSPS), under Section 306 of the CWA, for the offshore subcategory of the oil and gas extraction point source category of industrial dischargers prior to permit issuance for this lease sale. Therefore, the NPDES permit must be the subject of an environmental review under the National Environmental Policy Act (NEPA), pursuant to Section 511(c)(1) of the CWA. EPA expects to adopt the Final Environmental Impact Statement (EIS) for this lease offering in order to satisfy this requirement, in accordance with the requirements of the Council on Environmental Quality's (CEQ's) regulations governing the implementation of the procedural provisions of NEPA [40 CFR Part 1500].

EPA therefore offered to be, and was accepted as, a cooperating agency in the development of the EIS. The Minerals Management Service (MMS) requested that EPA provide an appendix to the EIS which would evaluate the impacts of exploration phase discharges on marine biota and water quality.

This appendix characterizes the expected discharges and evaluates their potential effects on the environment. This evaluation is based only on the discharges that will occur during exploration activities. It does not address impacts from petroleum development and production, impacts associated with noise, island or causeway construction, spills, or similar perturbations. In addition, cumulative impacts resulting from concurrent Lease 87 and Lease 97 exploration activities are addressed only in general terms because the precise timing and location of the actual exploration is unknown at this time.

DESCRIPTION OF ALTERNATIVES

This section first notes the estimated schedule for activities in the planning area and discusses the requirements applicable to EPA in its development of NPDES permits. Finally, it describes the alternatives being considered as a part of the development of the NPDES permit for the sale area.

Sale 97 is currently scheduled to be held in December 1986. Exploratory drilling in the blocks leased as a result of this sale could begin in 1987. The first delineation well could be drilled in 1988, the second drilling season. Drilling of exploration and delineation wells could continue through 1991. The amount of time required to drill and test exploration wells is estimated to be about 90 days. (Roberts, 1985).

CLEAN WATER ACT PERMIT REQUIREMENTS

Sections 301(b), 304, 306, 308, 401, 402, and 403(c) of the Act provide the basis for NPDES permit conditions. The general requirements of these sections fall into two categories, which are described below.

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Ocean Discharge Criteria:

Section 403 of the Act requires that an NPDES permit for a discharge into marine waters located seaward of the inner boundary of the territorial seas be issued in accordance with guidelines for determining the degradation of the marine environment. These guidelines, referred to as the Ocean Discharge Criteria (40 CFR Part 125, Subpart M), are intended to "prevent unreasonable degradation of the marine environment and to authorize imposition of effluent limitations, including a prohibition of discharge, if necessary, to ensure this goal" (45 FR 65942, October 3, 1980).

If EPA determines that the discharge will cause unreasonable degradation, an NPDES permit will not be issued. If a determination of unreasonable degradation cannot be made because of a lack of sufficient information then no discharge can be permitted except under a very limited set of circumstances. To permit a discharge EPA must be able to determine that the proposed discharge would not cause irreparable harm to the marine environment, and that there are no reasonable alternatives to on-site disposal.

To assess the probability of irreparable harm, EPA is required to make a determination that the discharger, operating under appropriate permit conditions, will not cause permanent and significant harm to the environment during a monitoring period in which additional information is gathered. If data gathered through monitoring indicate that continued discharge may cause unreasonable degradation, the discharge must be halted or additional permit limitations established.

The determination of unreasonable degradation must be based on the following factors: quantities, composition, and potential for bioaccumulation or persistence of the pollutants discharged; potential transport of such pollutants; the composition and vulnerability of biological communities exposed to such pollutants; the importance of the receiving water area to the surrounding biological community; the existence of special aquatic sites; potential impacts on human health; impacts on recreational and commercial fishing; applicable requirements of approved Coastal Zone Management Plans; marine water quality criteria developed pursuant to section 304(a)(1) of the Act; and other relevant factors.

This appendix is based, largely, on EPA's evaluation (against these criteria) of the effects of discharges resulting from oil and gas exploratory drilling on leases issued by MMS for OCS Lease Sale #87. Sale #87 includes submerged OCS lands that are entirely within the boundaries of the area being considered for lease in Sale #97. This analysis is referred to as an Ocean Discharge Criteria Evaluation or ODCE. EPA developed an ODCE for OCS Lease Sale #97. Its conclusions concerning the fate and effects of drilling effluent discharges were essentially identical to those reached in the ODCE for Sale #87. [Cooper Consultants, Inc., et. al; 1985].

Technology-Based Effluent Limitations:

The Act requires particular classes of industrial dischargers to meet technology-based effluent limitations established by EPA. The Act provides for implementation of these technology-based effluent limitations in three stages. First, application of "best practicable control technology currently available" (BPT) is required not later than July 1, 1977. In general, BPT represents the average of the best existing performances of well known technologies for control of traditional pollutants. EPA promulgated effluent limitations guidelines requiring Best Practicable Control Technology Currently Available (BPT) for the Offshore Subcategory of the Oil and Gas Extraction Point Source Category (40 CFR Part 435, Subpart A) on April 13, 1979 (44 FR 22069). BPT for this industrial subcategory limits the discharge of oil and grease in produced water to a daily maximum of 72 milligrams per liter (mg/l) and a thirty day average of 48 mg/l; prohibits the discharge of free oil in deck drainage, drilling fluids, drill cuttings, and well treatment fluids; requires a minimum residual chlorine content of 1 mg/l in sanitary discharges; and prohibits the discharge of floating solids in sanitary and domestic wastes.

Second, the Act requires that effluent limitations be based on the application of "best available technology economically achievable" (BAT), representing at a minimum the "best" treatment technology performance in the industrial category. Furthermore, control of "conventional pollutants" (oil and grease, biochemical oxygen demand, suspended solids, pH, and fecal coliform) must be achieved through "best conventional pollutant control technology" (BCT). Control of "toxic pollutants" (40 CFR 401.15) by BAT and conventional pollutants by BCT must be achieved by no later than July 1, 1984. In no case may BCT or BAT be less stringent than BPT. Permits must impose effluent limitations which control non-conventional pollutants (i.e., those which are not toxic or conventional pollutants) by means of BAT not later than July 1, 1987.

Finally, effluent limitations based on best demonstrated control technology must be imposed with the development of new source performance standards.

BAT/BCT effluent limitations guidelines and NSPS were proposed in August 1985 (50 FR 34592). Promulgation of these guidelines and standards is expected to take at least a year from the date of proposal. In the absence of effluent limitations guidelines for the Offshore Subcategory, permit conditions must be established using Best Professional Judgment (BPJ) procedures (40 CFR 122.43, 122.44, and 125.3). NPDES permits issued for offshore oil and gas operations will therefore contain BAT and BCT effluent limitations which reflect either promulgated guidelines or best professional judgment determinations, depending on when the guidelines and permits are issued. Previous BPJ determinations for offshore oil and gas exploratory operations were incorporated into the general permits for the Bering and Beaufort Seas (49 FR 23734, June 7, 1984) and for Norton Sound (50 FR 23578, June 4, 1985).

Proposed BAT guidelines would prohibit the discharge of free oil in the discharges; prohibit the discharge of drilling fluids that are oil-based or that contain diesel oil; prohibit the discharge of drill cuttings that contain diesel oil or that are generated with the use of drilling fluids that are oil-based; limit the acute toxicity of drilling fluid discharges; limit the mercury and cadmium content of drilling fluids; and require a residual chlorine content of 1 mg/l in sanitary discharges. Proposed BCT guidelines are the same as BPT. NSPS are proposed to be the same as BAT/BCT effluent limitations with one exception. NSPS would impose a prohibition on the discharge of

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produced water from all oil production facilities located in shallow water areas. Produced water discharges from all other offshore facilities engaged in exploration, development, and production activities would be limited to a maximum oil and grease concentration of 59 mg/l.

LAND DISPOSAL ALTERNATIVES

In the event that EPA decides (on the basis of the ODCE) to prohibit discharges of drilling muds from exploratory operations, several alternatives and techniques for land disposal are available. These include:

- Storage in pits or sumps;
- storage in abandoned gravel pits and quarries
- direct disposal over land surfaces; and
- subsurface injection or burial.

All land disposal alternatives for offshore drilling will require transportation of drilling muds and fluids to disposal sites. This could be accomplished by barging in the open water season and by truck during the ice-covered season. During freezeup and spring breakup the muds would have to be stored on-site if land disposal is required.

EXPLORATION LOCATIONS

There have been three lease sales (BF, 71, and 87) in this planning area before the currently planned sale. The Beaufort Sea planning area and currently leased blocks within the area are presented in Figure 1. As shown in Figure 1, many of the most shoreward blocks have already been leased. However, the sale 97 area extends offshore into waters deeper than those offered in the three previous lease sales. EPA may elect to modify the Sale 87 permit to include Sale 97 offerings. Additionally, the Sale 87 general permit regulates discharges from operations on state leased submerged lands, from state lease offerings 39, 43, and 43a, which are within the three mile limit.

Water depth ranges of the leased and unleased tracts of the Beaufort Sea Planning Area are summarized below:

Water Depth Range (m)	PERCENT WITHIN DEPTH RANGE Previous Lease Sales	Sale 97
Less than 20	60	Less than 10
20-40	25	Less than 20
Greater than 40	15	75

Source: Roberts (1985)

As indicated above, the majority of Lease Sale 97 is in water depths greater than 40 m. The Chukchi Sea (45 percent of the sale area; all depths greater than 40 meters) and the shoreward-most 15 miles adjacent to Point Barrow and the Arctic National Wildlife Refuge are proposed deferral areas within the Planning Area. These areas are shown on Figure 1. The final lease sale configuration may include any or all of these three areas.

COMPOSITION AND QUANTITIES OF MATERIALS DISCHARGED

TYPES OF DISCHARGES

The process of oil and gas exploration can produce a wide range of waste materials from the drilling process and from the maintenance and support of equipment and personnel. Discharges from exploratory drilling include:

- drilling muds
- drill cuttings
- sanitary and domestic wastewater
- desalination unit discharges
- boiler blowdown
- test fluids
- deck drainage
- uncontaminated bilge and ballast water
- non-contact cooling water
- fire control system test water
- blowout preventer fluid
- excess cement slurry

Sanitary waste discharges should be less than 10,000 gallons per day and would consist of secondary treated and chlorinated domestic sewage. Oxygen consumption of treated sewage effluent is a potential concern during under-ice disposal because ambient oxygen concentrations under ice may approach low levels (6 mg/l). However, dissolved oxygen depression resulting from this discharge would not be significant when ambient levels are at least 1 mg/l above the standard (usually 5 mg/l). Domestic waste (shower and sink drainage) should not result in a significant pollutant loading and is sometimes reused to make drilling muds, rather than discharged.

Desalination units may discharge approximately 200,000 gallons per day of seawater at a salinity which is twice as high as that of normal seawater. Boiler blowdown may be discharged once or twice a year and should not be a significant source of pollutant loadings.

Test fluids are discharged from a well upon its completion. They may consist of formation waters, oil, natural gas, or formation sands. They are stored and treated to remove oil before being discharged or flared. Previous permits have required that these discharges have a pH[1] of between 6.5 and 8.5.

Some deck drainage and fire control system test water may be produced and discharged during summer months. This would consist of rain and washwater from the deck and drilling floor, as well as water used to test the fire control system. Gutters would carry the drainage (and test water) to a sump tank where oil would be separated from the drainage before the water would be discharged. Bilge waters are also treated for the removal of oil prior to discharge. Although ballast waters are not similarly treated, previous permits have prohibited any discharges that would produce an oil sheen on the water.

The primary constituents of blowout preventer fluid are ethylene glycol and water. Ethylene glycol is not highly toxic and has been rated as a "minor" health hazard (Zajic and Himmelman, 1978; p. 23). Except for its elevated temperature, the composition of non-contact cooling water will not be significantly different from seawater.

Finally, cement, along with muds and cuttings, would be discharged on the ocean floor in the early phases of drilling, before the well casing is set, and during abandonment and plugging. These cement discharges are not expected to be a significant pollutant loading. (Jones & Stokes, 1984; Pp. 9-12)

QUANTITIES OF DRILLING MUDS AND CUTTINGS

Drilling muds and cuttings discharges are the major pollutants associated with exploratory drilling. For exploration and delineation wells, the estimated average depth, amount of drilling mud required, and weight of cuttings produced are shown in Table 1. The primary disposal method for drilling muds and cuttings would be discharge into the water at the drilling site under conditions prescribed by EPA's NPDES permit.

CHEMICAL COMPOSITION OF DRILLING MUDS

Drilling muds are complex mixtures of clays, barite, and specialty additives. The composition of drilling mud can vary over a wide range from one hole to the next, as well as during the completion of a single hole. As the hole becomes deeper and encounters different formations, the type of mud may need to be changed or the composition altered.

1. pH is a measure of the acidity and alkalinity of liquids. It measures acidity and alkalinity based on an index which quantifies the hydrogen ion concentration of the liquid being tested. pHs range from 1 to 14. Fresh water has a neutral pH (7). The scale is logarithmic; that is, a liquid with a pH of 6 is ten times more acidic than a liquid with a pH of 7.

Eight generic mud types have been evaluated by EPA during permit development. Because it is not known which of the muds will be used, a list of potential contaminants and their maximum authorized discharge concentrations has been compiled in Table 2. Water quality criteria are not available for these constituents, most of which are considered non-toxic.

In addition to the generic muds, downhole additives are used for specific problems that may be encountered. These additives can range from simple organic salts to complex organic polymers. These potential specialty additives are summarized in Table 3. The concentrations of these additives in mud can vary widely.

Water quality criteria are not available for most of the additives. Generally, quantities used are not large. Spotting material lubricants, zinc carbonate, and fillers (cellophane, mica hulls) are used in the greatest quantities. These additives are generally discharged to the environment. Collection and separation of spotting fluid contaminated muds is sometimes required.

The majority of these additive constituents are not highly toxic. Zinc compounds and petroleum-based formulations are of primary concern. Expected ambient concentrations cannot be quantified at this time, although they are expected to be low due to high dilution rates and low usage.

For exploratory discharges, the presence of potentially toxic trace elements in drilling muds and cuttings is of primary concern. Metals including lead, zinc, mercury, arsenic, and cadmium can be present as impurities in barite; chromium is present in chrome lignosulfonates and chrome-treated lignite. Drill pipe dope and drill collar dope may also contribute copper, lead, and zinc to the discharges. Data from several sources were combined to produce the expected whole mud maximum trace metal concentrations in drilling muds presented in Table 4 (Tetra Tech 1984).

Using dredged material elutriate partitioning data, Bigham et al. (1982) developed estimates of dissolved metal concentrations associated with drilling muds and cuttings. This approach was considered appropriate because the majority of bulk metals in both dredged materials and drilling muds are incorporated into the crystalline lattice of inorganic particles and are, therefore, not bioavailable. Table 5 presents concentrations of metals observed in the solid and dissolved fraction (based on elutriate analyses). The data represent approximately 50 separate analyses of sediments from the East and Gulf Coasts.

Table 1

Quantities of Materials Discharged

	Sale 97[a] Mean Resource Estimate	Sale 97[a] Maximum Resource Estimate
Exploration and Delineation Wells Average Depth (Meters)	4,050	4,050
Drilling Mud Requirements Average for all Wells (Dry Tons)	970	970
Total for all Wells (Dry Tons)	8,730	17,460
Drill Cuttings Average for all Wells (Dry Tons)	1,800	1,800
Total for all Wells (Dry Tons)	16,200	32,400

a. This table assumes that nine exploratory wells would be drilled in the mean resource case and that eighteen exploratory wells would be drilled in the maximum resource case. After completing the ODCE for this sale EPA received revised estimates for both the number of wells that are likely to be drilled in the Beaufort Sea planning area and the quantity of drilling muds which would be discharged. These revisions will be reflected in the final version of the appendix printed in the Final EIS.

Source: Roberts 1985, Table 16.

Table 2

Authorized Mud Components[a]

Generic Description	Maximum Authorized Concentration (Pounds per Barrel) (Unless Otherwise Noted)
KCl	50
Starch	12
Cellulose Polymer	5
Xanthum Gum	2
Drilled Solids	100
Caustic	3
Barite	450
Attapulgite	50
Bentonite	50
Lignosulfonate	15
Lignite	10
Soda Ash/Sodium	2
Lime	20.[b]
Acrylic Polymer	2

a. Not all components will be in a given mud.

b. Maximum for all mud types; lime addition is 2 for most muds.

Table 3

Authorized Specialty Additives

Primary Function	Generic Description*
Substitute for Attapulgite or Bentonite Clay:	Sepiolite
Detection of Filtrate Re-Entry into Mud System:	Ammonium nitrate Sodium nitrate
Detection of Formation Water Intrusion:	Sodium chloride
Mud lag time measurement:	Calcium carbide
Corrosion Inhibitor H_2S scavenger:	Zinc carbonate Zinc carbonate & lime Zinc oxide
Defoamer:	Aluminum stearate
	Aluminum stearate in propoxylated oleyalcohol
	Dimethyl polysiloxane in an aqueous emulsion
Dispersant:	Sodium polyphosphate
Emulsifier:	Sulfonated asphalt residuum
Filtrate Reducer:	Lignite resin blend
	Polymer treated humates Reacted phenol-formaldehyde-urea resin with no free phenol, formaldehyde, or urea
Flocculant:	Vinyl acetate/maleic anhydride copolymer
Lost Circulation Material:	Cellophane flakes Crushed granular nut hulls Silicate mineral mica flakes Vegetable plus polymer fibers, flakes, & granules

L-4

Primary Function	Generic Description*
Lubricant:	Fatty acid esters and alkyl phenolic sulfides in a solvent base
	Liquid triglycerides in a vegetable oil
	Oleates in mixed alcohols
	Phosphoric acid esters and triethanolamine
	Plastic spheres
	Vegetable ester formulation
Spotting Agent:	Sulfonated vegetable ester formulation
	Mineral oil-based fluids
Surface Active Agent:	Aqueous solution of nonionic modified phenol
	Blend of surfactants
	Ethoxylated alcohol formulation
	Fatty acid ester
	Water solution of anionic surfactants
Thinner:	Chrome-free organic mud thinner containing sulfomethylated tannin
Viscosifier:	Organophilic clay

* Any proprietary formulation that contains a substance which is an intentional component of the formulation, other than those specifically described, must be authorized by the Director. Some additives have two or more uses. However, only the first use of each additive is listed.

Source: Draft Norton Basin General Permit; 50 FR 23601-602; June 4, 1985.

Table 4

Maximum Trace Metal Concentrations Measured in Drilling Mud Discharges

Metal	Concentration (ppm)	Reference
Arsenic	24	a
Barium	398,800	b
Cadmium	4.2[c]	b
Chromium	1,300	d
Copper	88	d
Lead	88.[c]	b
Mercury	1.53[c]	b
Nickel	88	d
Vanadium	235	d
Zinc	1,350.[c]	b

a. Crippen et al. (1980, p. 649). Reported as ug/g drilling fluid.
b. Data derived from end-of-well chemical analyses reported to EPA Region 10 in discharge monitoring reports (mg/kg dry weight basis).
c. Higher concentrations of mercury, lead, and zinc were measured by Crippen et al. (1980, p. 649), but are not used here because the barite used in Crippen's study is not representative of drilling muds used on the Alaskan outer continental shelf. Cadmium concentrations are based on maximum values as reported in EPA NPDES discharge monitoring reports.
d. Northern Technical Services (1981, p. 91) (ppm drilling fluid) and Northern Technical Services (1982, p. 91) (mg/kg solid phase).

Source: Tetra Tech, 1984.

Table 5

Soluble and Solids Metal Concentrations in Dredged Materials Dumped At Sea, 1978 and 1979

Metal	Average Concentration Solid Phase mg/kg	Average Concentration Liquid Phase[a] ppm	Dissolved Constituent Concentration Ratio[b]
Arsenic	4.0	0.0049	0.0012
Cadmium	1.2	0.0016	0.0013
Chromium	33.0	0.0048	0.0001
Copper	30.4	0.0027	0.0001
Mercury	0.3	0.0003	0.0010
Nickel	15.0	0.0068	0.0005
Lead	29.6	0.0068	0.0002
Zinc	68.8	0.0325	0.0005

a. From results of elutriate test.
b. Liquid phase:solid phase (mg/l:mg/kg).

Source: Bigham et al. (1982, Pp. 292-294) as reported in Tetra Tech (1984, Table 10).

FATE AND TRANSPORT OF MUDS AND CUTTINGS DISCHARGES

The Offshore Operators Committee (OOC) Model was used to predict initial dilution and solids deposition for different conditions during the open water and ice-covered seasons in the Beaufort Sea. The behavior of exploratory discharges will vary relative to ice cover conditions. Expected dilution and deposition for the different ice conditions are described briefly below. Under-ice disposal is the most critical with respect to water quality impacts.

OPEN-WATER DISPOSAL

Muds and cuttings discharged during the open water season should encounter dynamic oceanographic processes to aid in dilution. Other outer continental shelf studies indicate dilutions on the order of 2,000:1 are found at distances of 100 m (330 ft) from the discharge point (Jones and Stokes, 1984; p. 35). These dilutions occurred in areas with current speeds ranging from 10 to 80 centimeters per second (cm/sec) which are comparable to those occurring during the open water period in the Beaufort Sea (average of less than 3 to 14 cm/sec and maximum of 95 cm/sec, depending on location).

Conditions used for the OOC model simulations and minimum dilutions are shown below, (Jones & Stokes, 1984; Pp. 36-39):

	CASE 1	CASE 2	CASE 3
Discharge rate, bbl/hr	1,000	250	1,000
Water depth, m	15	15	5
Unidirectional current speed, cm/sec	10	10	10
Minimum solids dilution at 100 m	1,750	2,560	4,810
Minimum dissolved dilution at 100 m.	530	2,540	200

This modeling, in conjunction with modeling performed by Tetra Tech (1984, Pp. 26-29) indicates that:

1. Within 80 m of the discharge point and with a 10 cm/sec current, particulate dilution increases as water depth increases. However, at distances greater than approximately 80 m, particulate dilution decreases as water depth increases.

2. Dissolved fraction dilution increases as water depth increases at all water depths modeled.

The case 1 and 2 simulations are considered to be most representative of the Sale 97 lease sale during open water because most of the area being offered is in deeper water. Minimum dilutions on the order of 2,000:1 should be expected at a distance of 100 m from the outfall.

Based upon the OOC modeling performed for preparation of the Sale 87 ODCE, the following generalizations may be made for the Sale 97 area.

Virtually all solids present in drilling mud discharges would eventually deposit on seafloor sediments downcurrent from the discharge point. Deposition characteristics and patterns would be extremely variable and would be strongly influenced by several factors including the type and quantity of mud discharged, the solids concentration in the discharge, hydrographic conditions at the time of discharge, and the height above the bottom at which discharges are made.

Model results indicate that for the higher discharge rate, a smaller area would be affected but sediment accumulation depths would be greater. For a discharge rate in the range 250-1,000 bbl/hr and water depth of 15 m, the area of seafloor receiving muds deposition of greater than 1 mm at each drilling site was predicted to range from 1.2 to 2.2 hectares (ha) depending on the discharge rate (Jones and Stokes, 1984; pg. 60). From Roberts (1985) it can be assumed that in any given year, two units will be operational. Thus, a total depositional area (greater than 1 mm in depth) from drilling muds will accumulate at the rate of 2.4 to 4.4 ha/year. The total area within Sale 97 that would receive deposition greater than 1 mm during open water is estimated to be 10.8 to 19.8 ha for the mean resource case and 21.6 to 40.0 ha for the maximum resource case. In tracts deeper than 15 m, the solids deposition area is expected to increase while the deposition thickness decreases (Jones and Stokes, 1984; pg. 44). Depth estimates for Sale 87 are, therefore, conservative for the deeper Sale 97 tracts but the area affected may be underestimated.

At 1,000 bbl/hr, a maximum muds deposition of 50 cm is predicted to occur 30 m downcurrent of the discharge. For 250 bbl/hr, maximum deposition at 30 m is 29 cm. In both cases, cuttings (not included in above estimates) are expected to settle more rapidly than muds and to accumulate to greater depths over a smaller area. As shown in Table 1, quantities of cuttings are approximately twice that projected for drilling muds. The cuttings discharged from an artificial gravel island would probably be deposited on the submerged toe of the island.

Solids accumulation and persistence are a function of the energy level of the system. Accumulation of drilling materials on the seafloor is inversely related to the energy of the ambient environment. A low energy environment does not contain currents capable of removing or vertically mixing deposited material. Surface waves have been shown to resuspend sediment to a depth of approximately 70 m (230 ft), and bottom currents greater than approximately 20 cm/sec have been shown to resuspend deposited materials. In shallow (less than 70 m) portions of the Lease Sale 97 area, resuspension of sediment may occur during the open water season. Data are not available for deeper offshore areas, but it is likely that slow currents and depth will preclude any resuspension after the initial deposition.

Dynamic oceanographic processes in the inshore area can be expected to reduce the depth of deposition in areas of greater circulation, while extending

the area of dispersion. Deeper environments such as encountered in the offshore portion of Sale 97 (approximately 90 percent of exploration effort) can be expected to accumulate solids to shallower depths over a larger area (Jones & Stokes, 1984; p. 44, 59).

It should be noted that current regimes are highly variable and the above projections would not necessarily be applicable on a site-specific basis. On a very limited scale somewhat more pronounced mixing and transport might be seen for discharge in an extreme inshore location.

ABOVE-ICE DISPOSAL

The Beaufort Sea is generally ice-covered from October through May. Disposal above ice is usually accomplished by depositing the material on the ice in large frozen chunks, with no layering attempted. It may also be spread thinly on the ice (in layers), within berms, which keep the disposal site intact as long as possible. Dilution and dispersion of the effluent occur at ice breakup, when greater wind and water movement are present. Mud disposed of as large chunks may not be dispersed to the same extent as the layered discharges.

Above-ice disposal allows slow release of drilling muds to the water column. Mud behavior depends on the physical and thermal properties of the mud and the sea ice. Key factors influencing the dilution and dispersion of above-ice discharges include the relative ablation rates of the muds and sea ice, water depth, river over-flooding rates, and oceanographic conditions during ice breakup.

Above-ice disposal of drilling muds can cause local modifications in the way the ice melts at the disposal site during breakup. Mud tends to melt earlier than the sea ice, although layers thicker than 1 cm retard ablation of the sea ice (Northern Technical Services, 1981; p. 8). The liquid portion of the effluent drains through cracks in the ice at initial breakup. The solid fraction of the discharge remains on top of the ice until the later stages of ice breakup. Dilution of mud is maximized for disposal sites that remain intact until the final stages of ice breakup (Northern Technical Services, 1982; p. 5). This allows the mud to be released more slowly and, in the presence of dynamic oceanographic processes, results in greater dilution and dispersion.

Modeling of the transport and fate of muds in above-ice disposal sites is difficult due to the complexities of ice breakup processes. Field study results show that the maximum mud concentration entering the marine environment from above-ice disposal sites is much less than the concentration introduced by below-ice disposal methods. Therefore, the potential adverse effects from above-ice disposal should be substantially less than those caused by below-ice discharge (Northern Technical Services, 1981; Pp. 6-121). If the solids are released slowly, dilution of muds discharged above ice should be similar to or greater than that occurring during discharge to open waters. In shallow water, ice may melt in place. This would cause the muds and cuttings to be deposited in a relatively confined area and, consequently, increase the depth of accumulated muds and cuttings until such time as currents redistributed the material.

UNDER-ICE DISPOSAL

The nearshore Beaufort Sea is covered by ice for approximately eight months of the year, from early October through late May. Oceanographic conditions during ice cover are very different from those of open water season. This, in turn, affects effluent dispersion. Current velocities are much lower under the ice pack than during the open water season. Matthews (1981) and Aagaard and Haugen (1977) studied winter currents in the Beaufort Sea area. Matthews (1981, p. 70) measured mean current speeds of 5.9 cm/sec under ice. At 10 m below ice in water depths of 30 to 40 meters offshore of Narwhal Island, Aagaard and Haugen (1977, Pp. 40-42) observed velocities generally less than 5 cm/sec with mean flow ranging from 0.1 to 0.3 cm/sec. Near Mukluk Island (in water depths of 45-50 m) winter currents are typically less than 2 cm/sec (Northern Technical Services, 1984; p. 6). Mean monthly wind speeds are higher in winter, but the winds do not significantly affect the current regime because of the ice cover.

Of all the disposal methods described, below-ice discharge introduces the largest peak concentration of muds to the environment. A stratified, low-energy environment exists throughout the winter months, restricting dilution and increasing solids accumulation. Water depth, reduced because of the ice cover, can directly influence dilution by restricting the available entrainment area. Shoreward of the 15 m (49 ft) isobath the floating-fast ice may reach thicknesses of up to 2 m (6.6 ft).

The combination of shallow water and low current velocities during periods of ice cover will lead to minimal dilution and dispersion. Existing studies are inconclusive as to the magnitude of expected dilution in depths of less than 10 m (33 ft). Actual dilution values in low energy environments such as the ice-covered Beaufort Sea are presently unknown (Jones and Stokes, 1984; pg. 3). However, a low-energy environment having current velocities less than approximately 20 cm/sec is not subject to currents capable of resuspending and transporting deposited material.

The OOC model was used to predict initial dilution and solids deposition of below-ice discharges in Beaufort Sea. Initial conditions and dilutions for the model simulations were:

	CASE 4	CASE 5
Discharge rate, bbl/hr	250	1,000
Water depth, m	17	42
Current Speed, cm/sec	2	2
Minimum particulate dilution at 100 m	8,870	2,000
Minimum dissolved dilution at 100 m	2,240	2,200

For a discharge of 1000 bbl/hr in 42 m depths, the area of seafloor receiving deposition greater than 1 mm thick for each well site is predicted to

be approximately 5 ha (Jones and Stokes, 1984; pg. 62). Total area receiving deposition from 18 wells (maximum resource case) would be 90 ha. Maximum mud deposition is expected to be 7 cm deep and is predicted to occur approximately 30 m downstream of the discharge. Cuttings will accumulate to a greater depth but will affect a smaller area.

OBSERVATIONS AT MUKLUK ISLAND

General conclusions regarding the Sale 97 area may also be drawn from studies performed by NORTEC (1984) to identify the fate of drilling muds discharged from an exploratory oil and gas well drilled on Mukluk Island. Mukluk Island, an artificial gravel island, is located in Harrison Bay approximately 45 km northwest of Oliktok Point. The results of this study contribute to understanding the fate of drilling muds discharges, particularly in relatively deeper water environments within the Beaufort Sea.

Grain size analyses of bottom sediments from the vicinity of Mukluk Island indicated some effects of actual island construction. Effects of island construction include an increase in coarse grained materials at stations less than 100 m from the waters edge (or 55 m from the toe of the island). Previous investigations regarding drilling effluent deposition in the Beaufort Sea (Northern Technical Services 1981, 1982, 1983) have found that grain size analysis normally does not provide sufficient resolution to detect the presence of drilling muds in bottom sediments. Consequently, trace metal analysis, which is a more sensitive test, is commonly used to determine the fate of discharged muds. Because barium and zinc are elevated in muds relative to ambient sediments, these metals were selected as tracers of the drilling muds deposition.

Increased barium levels were observed in the vicinity of Mukluk Island in both the pre- and post-discharge bottom sampling. Increased pre-discharge levels were limited to distances less than 200 m from the edge of the island at waterline (or 155 m from the toe of the island). These pre-discharge levels were attributed to deposition of fine grained materials from island construction activities. Increased barium levels from the post-discharge sampling were limited to distances less than 500 m from the island at waterline (or about 455 m from the toe of the island). Those additional increases over the pre-discharge levels are believed to be associated with drilling effluent discharges.

In general, trace metal analysis of bottom sediments from the vicinity of Mukluk Island shows that drilling muds were observed at locations up to 200 m away from the island (Northern Technical Services; 1984, p. 36).[2] Although metals levels were elevated above normal ambient levels, they were still within the range of values found elsewhere in the Beaufort Sea.

Previously completed investigations suggest that trace metal vels should be considerably less than actually measured at Mukluk Island. The higher metal levels observed at Mukluk can probably be attributed to the fact

2. There were no monitoring stations between 200 m and 500 m from the island. We therefore do not know whether metals levels were elevated, due to muds discharges, within that range.

that effluents were discharged near the seafloor where wave induced turbulence, hence resuspension, is minimal. Given the water depths, NORTEC (1984) calculated that an approximately 4.5 second wave (or longer period) would be required to resuspend and transport drilling effluents. Waves of this size typically do not occur until late August or September. As such, it is likely that drilling muds may persist longer in deeper waters, such as found in the vicinity of Mukluk Island. All previous investigations in the Alaskan Beaufort Sea have been conducted in much shallower waters where nearly any wave action (periods much less than 4.5 seconds) could result in resuspension of materials deposited on the seafloor.

WATER QUALITY

The CWA 403(c) regulations allow a 100 m radius mixing zone for initial dilution of the effluent. At the edge of the mixing zone, marine water quality criteria must be met. The Offshore Operators Committee (OOC) and EPA discharge models were used to predict worst case initial dilution and solids deposition of below-ice disposal in the Beaufort Sea for two discharge rates and two water depths. The worst case predicted by the computer model consisted of a discharge of 1,000 bbl/hr into 5 m of water and a current speed of 10 cm/sec. The dilution achieved at the edge of the mixing zone was approximately 200:1 in the 5 m depth simulation for dissolved metals (Jones and Stokes, 1984; p. 111). The Sale 97 offerings are in deeper water, therefore, dilutions are expected to be much greater.

Table 6 presents a comparison of applicable water quality criteria with ambient concentrations predicted using a dilution of 200:1 and the whole mud metal concentration shown in Table 4. Use of the whole mud concentration is considered appropriate since the criteria are operationally defined in terms of total recoverable concentrations. These concentrations represent metals that exist in the dissolved phase plus the metals that are more tightly bound to particulates. Based on these results, water quality should be well within the applicable marine water quality criteria, outside of the zone of initial dilution, for exploratory phase discharges.

Table 6

Comparison of Expected Dissolved Metals Concentrations at the Edge of the Mixing Zone in Lease Sale 97 to Marine Water Quality Criteria

Metal	Dissolved Concentrations[1] ppm: In Discharge[2]	Dissolved Concentrations[1] ppm: At 100m from Discharge[3]	Marine Criteria[4] (one hour average)
Arsenic	0.024	0.0001	0.069
Barium	399.0	2.0	No Criterion
Cadmium	0.004	0.00002	0.0439
Chromium	1.3	.006	1.100[5]
Copper	0.088	0.0004	0.003
Lead	0.088	0.0004	0.140
Mercury	0.002	0.00001	0.002
Nickel	0.088	0.0004	0.1406
Vanadium	0.235	0.001	No Criterion
Zinc	1.350	0.007	0.170[6]

1. Based on maximum whole mud metal concentrations as reported in Table 4.
2. Dissolved concentrations represent 0.1 percent of total concentration in muds. (See dissolved constituent concentration ratios in Table 5.)
3. Assumed dilution 200:1. Corresponding to discharge of 1,000 bbl/hr into water depth of 5 m and current speed of 10 cm/sec.
4. From 50 FR 30784. EPA 1985. One hour average concentration (ppm) not to be exceeded more than once every three years on the average, based on the total recoverable method (see note 6, below).
5. Hexavalent chromium
6. From 45 FR 79318. EPA 1980. Maximum allowable concentration (ppm) based on total recoverable method which is operationally defined as the concentration of metal in an unfiltered sample following treatment with hot diluted mineral acid (EPA 1979).

EFFECTS ON MARINE BIOTA

INTRODUCTION

In general, the Beaufort Sea marine ecosystem can be portrayed as two interrelated natural systems. The nearshore environment extends from the shoreline to a depth of approximately 20 meters and the offshore habitat extends from the 20-meter depth seaward. Figure 2 portrays the fundamental biochemical relationship of the two systems, wherein there is a major transport of marine carbon and nutrients from the offshore to the inshore (Truett, 1984b; p. 184).

As expected, marine zooplankton and phytoplankton are common to both systems as major food sources for higher trophic levels. Primary food sources for nearshore vertebrate species include epibenthic crustaceans (principally amphipods and mysids) and to a much lesser extent, zooplankton (Griffiths and Dillinger, 1980). With the exception of the benthic-feeding bearded seal, the primary food of offshore vertebrate assemblages appears to be zooplankton and other vertebrates (U.S. Army Corps of Engineers, 1984; p. 3-55). Bearded seals are the exception; their primary prey are motile benthic epifauna.

The relative importance of benthic infauna to key higher trophic levels in the Beaufort Sea appears to be indirect, (through conversion of primary productivity) in comparison to more direct food web contributions of the epifaunal benthos. Under-ice (epontic) habitat also plays a key role in the biology of the arctic ecosystem. A more thorough discussion of the biological resources of the planning area can be found in Chapter III, Section B of this EIS.

Due, largely, to the short term nature of the physical impacts of discharges from exploratory and delineation drilling, the trophic relationships most affected will probably include benthic infaunal and epifaunal communities in waters deeper than five meters, as well as benthic feeders. The nearshore biota appear to be resilient, ostensibly due to large scale periodic physical and food web changes resulting from natural processes (Truett, 1984b; p. 245). Finally, nearly 90 percent of Sale 97 exploration activities are expected to be conducted in the offshore areas (i.e., waters of depths greater than 20 meters). Therefore, offshore biota are of primary concern for activities associated with Sale 97.

EFFECTS ON BENTHIC COMMUNITIES

The National Research Council (NRC) (1983, p. 105), Ferbrache (1983, p. 12) and Jones & Stokes (1984, p. B-19) have summarized the work of Petrazzuolo (1981), Neff (1981) and Brandsma (1980), identifying the potential detrimental benthic impacts of discharged drilling fluids and cuttings in low-energy environments as:

a) Physical smothering of benthic epifauna and infauna.

b) Introduction of substances which may have negative effects upon metabolism, health, behavior, or reproductive capability of benthic species.

c) Alteration of sediment chemistry and texture, making it unsuitable for certain species, e.g., interference with burrow construction and feeding or interference with settlement of benthic larvae.

Smothering:

Research and data collection efforts indicate that if a depositional mound or cuttings pile remains on the seabed following discharge, population depressions and/or changes in the benthic community will occur. The suspended solids content of these discharged fluids consists mainly of barite and bentonite. Cuttings are generally sand grain sized and settle out at relatively short distances from the point of discharge.

Localized depression of faunal communities due to smothering effects will be most likely in areas where deposition of cuttings on the benthos exceeds 1 cm and persists for more than a few days (Jones & Stokes, 1984; p. B-19). More subtle community changes may result from alteration of substrate characteristics. Species will be favored which are more tolerant of the deposition of increased silt/clay components derived from drilling fluids. Increased requirements for feeding, respiration and reproductive energy may cause adverse impacts, and depressed larval recruitment may occur (Menzie et al., 1980; p. 511). Menzie noted reduced abundances in polychaetes, molluscs, and crustaceans up to 370 meters from a well site in a low energy mid-Atlantic Outer Continental Shelf drill site in 120 meters of water. However, hake (Urophycis spp.) and crabs (primarily Cancer borealis) were apparently attracted to the drill site. Abundance of sand stars (Astropectin americanus) appeared unaffected.

Species attracted to the harder substrates of intact mounds may colonize this newly-formed area in response to a "reef effect" (Shinn 1974 and George 1975 in Northern Technical Services, 1981, and Menzie et al., 1980; p. 504). Increased predation resulting from the attraction of predator species may result in a net reduction of prey species as an indirect impact (Menzie et al., 1980; p. 511). Such an indirect impact could reduce localized nearshore reproductive success and recruitment of important motile epifaunal species (i.e., gammarid amphipods), with attendant impacts to higher trophic levels.

Toxicity, Bioaccumulation, and Biomagnification:

Houghton et al. (1980; Pp. 1018-1019) identified lignosulfonates and caustic soda (sodium hydroxide), through an effect on pH, as the most acutely toxic components of water-based drilling fluids. The NRC (1983, p. 2) identified diesel fuel (No. 2 fuel oil) and biocides as two of the most toxic constituents which may be present in some drilling muds. Duke and Parrish (1984, p. 56-62), for example, showed a strong positive correlation between diesel content and toxicity. While the concentration of a mineral oil product was similarly correlated with toxicity, the mineral oil was less toxic than diesel.

EPA Region 10's permits for offshore drilling operations have prohibited the discharge of diesel oil and limited the toxicity of drilling muds. The toxicity of new drilling mud additives must be tested prior to their use and discharge. Among the most toxic additives authorized for discharge are mineral oil products used as lubricants and spotting fluids (EPA Region 10 permit files).

Heavy metals also occur in high concentration. They are of greatest concern, since they do not biodegrade and are not neutralized in seawater as are caustic soda and lignosulfonates. Statistically significant accumulations of metals have been found in tissues of various benthic species subjected to drilling fluids (Mariani et al. 1980, p. 448). However, there appears to be low bioavailability if the exposure is short term (McCulloch et al., 1980). Effects on benthic invertebrates are apparently sublethal (USDOI/MMS, 1984; p. IV-49), and there is no correlation of tissue metals with abundance or community structure change (Crippen et al., 1980; p. 636; Menzie et al., 1980).

Crippen et al. (1980) reported no correlation between the level of heavy metals in the substrate and tissue metals levels. Other investigators have reported such correlations and it can be expected that some species could have some elevation of metal concentrations. Concentrations would depend on the species, currents (i.e., dilution), and a variety of other factors. Within the context of currently available information, for exploratory drilling operations it is likely that accumulations of heavy metals in deposited drilling muds will be minor, even in low energy environments (Ferbrache 1983, p. 41).

Studies by Gerber et al. (1980, p. 891) indicate that toxic and sublethal effects would be expected on organisms exposed to used drilling fluid discharges close to the source. At high discharge rates of 275-1,000 bbl/hr, toxic impacts (the lowest concentration found acutely toxic) might occur 20 to 35 meters downstream from the point of discharge. However, that study also found that animals exposed to sublethal levels of contaminants would be expected to recover in clean environments.

Recovery:

Although return to pre-drilling community structure or abundance appears slow in a low-energy environment, Menzie et al. (1980) and other authors suggest that benthic communities within the initial impact zone commence recovery within a year following cessation of discharge. Nearshore

changes in community structure should return to background levels of variability as drilling fluids and cuttings are dispersed by wave-induced resuspension of sediments, ice-gouging and long-shore mixing. In deeper, low-energy portions of the nearshore, reworking of persistent, built up materials by benthic communities and recolonization from adjacent areas will contribute to recovery of smothered species and reestablishment of community structures.

Conclusions:

No geographic areas of specific importance for benthos potentially affected by the discharges have been identified. The following factors should result in limited benthic community effects from drilling fluid discharges:

- the potential for resuspension and further dispersion and dilution of contaminated sediments by periodic high current velocities and storm events;
- the relatively low numbers and diversity of infaunal organisms in areas of intensive ice-gouging;
- the mobility of many of the trophically important epibenthic organisms (mysids and amphipods); and
- the control of toxic pollutants effected through the BAT and NSPS effluent limitations.

Transitory and localized impacts from exploratory drilling may occur on the benthos of the sale area. Due to the limited quantity of materials which would be discharged and the small area affected by those discharges, the impacts would be insignificant.

EFFECTS ON LOWER TROPHIC LEVELS

Phytoplankton:

No geographic areas of specific importance for phytoplankton productivity have been identified. The possible impacts of drilling mud discharges on marine phytoplankton include:

- Decreased primary production due to light reduction from increased turbidity;
- Decreased primary production and or increased mortality due to direct acute or sublethal toxic effects of trace metals;
- Stimulation of primary production by trace nutrients in the discharge. (Jones & Stokes, 1984; p. A-9).

Several considerations suggest that the discharge of drilling muds will have little immediate impact on phytoplankton. First, the rapid dilutions and

short residence time for suspended solids and toxic materials in the water column make it very unlikely that phytoplankton would be exposed long enough to the high concentrations necessary to show toxic effects. Second, the discharges are intermittent and of relatively short duration. Third, most metals in the discharge are bound to particulates and are, therefore, unavailable for uptake by the organisms. Fourth, the area likely to be covered by detectable discharge plumes is very small. Finally the significant potential for recruitment from nearby unaffected areas means that recovery periods should be relatively short. (Jones & Stokes, 1984; Pp. A-9 -- A-10).

Zooplankton:

Possible impacts to zooplankton include:

- Decreased growth, altered behavior, and/or increased mortality due to the direct acute or chronic effects of toxic materials in drilling muds;
- Interference with feeding or respiratory activity due to increased suspended solids concentrations;
- Indirect enhancement or inhibition of zooplankton populations resulting from impacts on phytoplankton. (Jones & Stokes, 1984; p. A-10).

Although these impacts are theoretically possible, no significant impacts are expected for the same reasons as outlined in the discussion of phytoplankton impacts, above.

EFFECTS ON FISH RESOURCES

Fish and most motile pelagic species should be able to avoid discharge plumes and areas of high turbidity resulting from exploratory drilling operations. Jones & Stokes (1984, p. C-16) suggest that although some studies have indicated that fish may be attracted to a discharge plume, it is likely that stresses induced by particulates in the main body of the plume would restrict fish to the plume edges. These factors also mean that fish are unlikely to experience significant exposures to toxic concentrations of pollutants in the discharge. Following cessation of discharge, fish will return to a discharge area, particularly if the settlement of discharged cuttings and drilling fluid provides significant microrelief (i.e., creation of new habitats).

While little is known regarding the threshold at which effects from smothering or toxic effects on demersal fish eggs could occur, the wider dispersion of discharged drilling fluids in deeper areas could result in a large area being covered with more than 1 mm of muds and cuttings. This could result in the smothering of eggs of cottids (Arctic cod) and other demersal fish (Jones & Stokes, 1984; p. C-16). However, under actual field conditions, the area affected should be relatively small.

Finally, the limited effects which the discharges would have on benthic communities, phytoplankton, and zooplankton suggest the food supply reductions (for the fish) will be inconsequential (Jones & Stokes, 1984; p. C-19). Thus, only minor impacts on fish are anticipated from exploratory phase discharges.

EFFECTS ON MARINE MAMMALS (ENDANGERED & NON-ENDANGERED)

Exposure to Discharges:

"Marine mammals are large and mobile, and in many cases are only migrants through the lease sale area. Because many species are sensitive to noise and human activity, the drilling process should keep most mammal species at a distance, and therefore away from direct contact with the discharge plume."

". . . Discharge [of muds and cuttings] is expected to be intermittent and relatively brief, and exposure of mammals to the plume, especially to the most concentrated portions, is unlikely. Exposure to settled muds on the bottom would be possible, at least in shallower portions of the lease sale area. Above-ice disposal would allow mammals such as seals and bears to have contact with muds, primarily in frozen form, but it is not likely to be ingested." (Jones & Stokes, 1984; p. D-13).

Acute and Chronic Toxicity:

"Acute and chronic toxicity levels for drilling muds and cuttings have not been determined for marine mammals. However, it is unlikely that [they] would remain in contact with the discharge for sufficient periods to receive exposure to acutely or chronically toxic levels of metals in either the water column or the bottom sediments. Because of the limited number of wells and intermittent discharge of materials, and dispersion/dilution expected, any acute or chronic effects . . . are judged to be unlikely." (Jones & Stokes, 1984; p. D-13).

Bioaccumulation and Food Supply Effects:

"Insufficient information exists to predict the extent to which an individual mammal would feed on contaminated food, or the extent to which any particular prey species or mammalian predator will bioaccumulate heavy metals (such as mercury). However, bioaccumulation of heavy metals in mammals from drilling muds and cuttings discharged during exploratory drilling is judged . . . [to be an insignificant] concern based on the relatively limited volumes of wastes discharged; the limited number of exploratory wells to be drilled; the limited areal extent of elevated heavy metals concentrations in the water column and sediments; and the mobility of mammals which allows selection of food from a variety of uncontaminated as well as contaminated locations." (Jones & Stokes, 1984; p. D-14).

For similar reasons, indirect effects through food supply reductions are not expected.

EFFECTS ON MARINE AND COASTAL BIRDS

Exposure and Toxicity:

> "Direct exposure of birds to the discharge would require contact with the plume or settled muds. Discharge will be intermittent, and much of the material will settle out relatively rapidly following cessation of the discharge. It also seems likely that most birds would choose to forage in less turbid water where prey are more easily spotted. Therefore, although no data exist concerning acute toxicity of muds and cuttings on birds, no direct acute or chronic effects are [expected to occur]." (Jones & Stokes, 1984; p. E-11).

Bioaccumulation and Food Supply Effects:

> ". . . [M]etal accumulation is judged [to be an insignificant] concern because of the limited number of wells to be drilled, [the] limited extent of contamination in benthic or pelagic prey species, and the mobility of birds and most prey species. Measurable impact would be likely only if the drilling were to [affect] large portions of major feeding areas for an extended period. . . . [B]ased on previous analyses, food supplies for species feeding offshore on invertebrates or fish are unlikely to be noticeably reduced . . ." (Jones & Stokes, 1984; p. E-12).

CUMULATIVE EFFECTS

Irreversible and significant impacts to the marine biota are not anticipated, due to the limited areal extent and quantities of discharge associated with Sale 97 exploratory drilling activities, as well as anticipated low number of exploration/delineation drilling units available at one time (Roberts, 1985; Table 5). Furthermore, it is unlikely that exploratory wells will be drilled adjacent to sites from previous sales which are either planned for exploratory drilling or production, or currently in production. Such potential cumulative impacts could result from concurrent and nearby drilling, particularly in nearshore areas, with open water discharge. Even in the low likelihood that adjacent impacts could become cumulative under as yet unspecified conditions, insufficient data are available to predict impacts with any significant degree of certainty.

EFFECTS OF LAND DISPOSAL

INTRODUCTION

Lam (1982) reported on several disposal methods in a survey of drilling fluid disposal techniques for Canadian offshore drilling. He found that the suitability of land disposal was dependent upon the availability of acceptable sites of sufficient size in an appropriate location. In his opinion the major disadvantage to land disposal is that it is not a permanent solution to the problem because sites eventually fill and new locations must be sought. He stated that for offshore drilling the method is even more unattractive because of the high cost of transportation or drilling a disposal well. Lam did conclude that the method might be considered for certain locations if the fluids could be dewatered before transport.

STORAGE IN PITS OR SUMPS

Impacts associated with disposal of drilling muds in pits or sumps would include the land area required to form the pit and that needed for distribution and docking facilities and haul roads if the pits are not located near the barge docking facility or pipeline terminus. The analysis assumes that standard arctic construction practices protecting permafrost will be used.

Dragnich (1983) reported that reserve pits of 50-60,000 barrels capacity were used by Exxon for storage of drilling muds and cuttings for onshore drilling in the Beaufort Sea area. The magnitude of land loss is dependent upon how many such pits would be needed and how much time would be required to reclaim these lands with vegetative cover.

The Alaska Department of Environmental Conservation has just issued guidelines for onshore disposal of drilling muds in pit facilities. (ADEC, 1985). Pits are generally constructed above grade with gravel dikes and bottoms to protect permafrost. The guidelines encourage using a landfill. That is, it is desirable to maximize the solids and take out liquids before the muds are deposited in the pit. This will limit problems with leaching and breaking of dikes. When the pit is filled, a 2-foot thick gravel cap is to be placed over the top. The gravel may contain some bentonite. The cap may be scarified and fertilized to encourage vegetation recovery by native tundra species but such recovery will probably take five or more growing seasons.

Meyers and Barker (1982), as well as Dietrich (1985), point out that a considerable volume of drifting snow may accumulate in these pits during the winter. During spring breakup, there is danger of flooding and dike breaching unless these pits are dewatered. Disposal of fluids, normally done by vacuum truck, is accomplished by spraying on roads and pads for dust control. However, there are several limitations and inefficiencies associated with this technique, including insufficient number of trucks to service all pits and the water quality of these fluids. Water quality varies with age of the pit (older pits generally have better water quality) and can vary over the summer period as well.

Drilling muds and fluids may contain potentially toxic materials such as oils and grease, heavy metals, soluble salts and various synthetic and natural organic compounds. If pits are not lined, these materials may leach into surface and groundwaters and pose potential hazards to organisms in or directly dependent on these resources. If left exposed, these pits may attract waterfowl and other wildlife and pose potential hazards to them as well.

The major problem associated with pit water is salt contamination but total suspended solids, pH, oil, total organic carbon and chemical oxygen demand can also present problems. Salt levels in the four pits studied by Meyers and Barker ranged from 605 mg/l to 5,257 mg/l total dissolved solids (TDS). They found that impacts of spraying pit water on tundra vegetation were directly proportional to the salt concentration applied; at 4,000 mg/l TDS physiological stress was induced in willows but below 2,000 mg/l TDS these species were not affected. Other species tested were less sensitive than willows. Pit fluids did not significantly concentrate in soils or adversely affect soil conductivity or pH. In addition to salt induced problems, mechanical and physical damage to vegetation can be induced during water discharge unless some means of energy dissipation is used. Meyers and Barker (1982) conclude that direct tundra disposal of pit fluids can be environmentally acceptable under certain circumstances. Limitations on salt content, mitigation for physical damage to tundra and a sampling program conducted concurrently with dewatering are recommended to ensure safe operation.

STORAGE IN ABANDONED GRAVEL PITS AND QUARRIES

Except that no new land areas are needed for pit construction, storage of drilling muds in abandoned gravel pits and quarries poses many of the same problems encountered with storage pits constructed expressly for that purpose. However, because of their size or irregular shape, it may not be possible to line gravel pits or otherwise protect them from the leaching of potentially hazardous materials to surface and groundwaters. Location of abandoned gravel pits may or may not make them more accessible to barge or pipeline transportation of waste drilling muds. This alternate has not been recommended or documented by any known source.

DIRECT LAND DISPOSAL

There are no known studies dealing with the effects of direct application of fresh water drilling muds to tundra vegetation and soils (Dietrich 1985). The U.S. Fish & Wildlife Service (FWS) has begun to look at effects from land disposal for older wells (30 years old) but results of these studies are not yet available. Disposal of drilling muds directly on the tundra poses several potential impacts.

As discussed above, physiological damage to vegetation as a result of high salt concentrations and physical damage from spraying can occur as a result of dewatering pit storage facilities. It is assumed that fresh muds may be more saline and might therefore cause greater physiological stress to tundra plants. Certainly the possibility for physical/mechanical damage is greater due to the greater weight and potential for smothering and burial of

vegetation. Heavy metals and oils and greases may pose additional problems. Heavy metals may be taken up by plants and accumulated and magnified in food chains. Oils and greases can have direct toxic and damaging physical effects on vegetation and soils (Walker, et al. 1978; Everett, 1978). The area potentially affected by direct land disposal could be significantly larger than the area affected by the other land disposal alternatives.

Ferrante (1981) reported that:

> Studies with terrestrial plants in laboratory and field experiments show that the fluids and some fluid components exhibit phytotoxic properties reducing seed germination, growth and yield. Phytotoxicity in whole drilling fluid is attributed to soluble salt concentrations. The range of lethal concentrations of fluid components in toxicity studies was from less than 1 to 75,000 mg/l and that for whole drilling fluids from 0.29 to 85 percent by volume.

SUBSURFACE INJECTION

Subsurface injection of drilling muds at the drillsite is currently a common disposal technique (Dietrich 1985). A subsurface zone, approximately 2,000 to 3,000 feet deep, has been found in the Beaufort Sea area that can accommodate this disposal method. Impacts of onshore subsurface injection would include transportation and logistic impacts, noted in the alternatives section of this appendix, as well as impacts associated with exploring for and drilling additional onshore injection wells.

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FIGURE 1

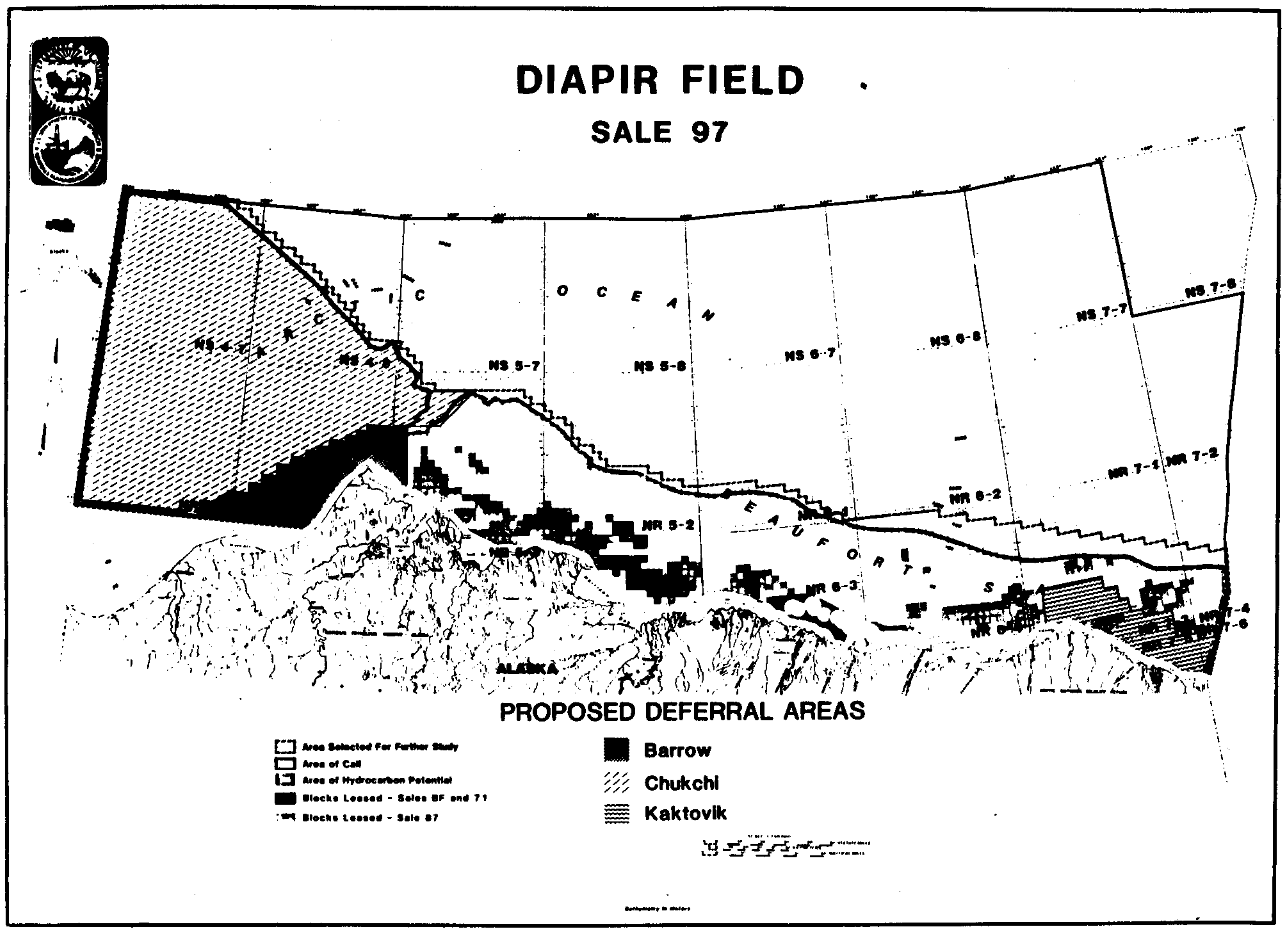
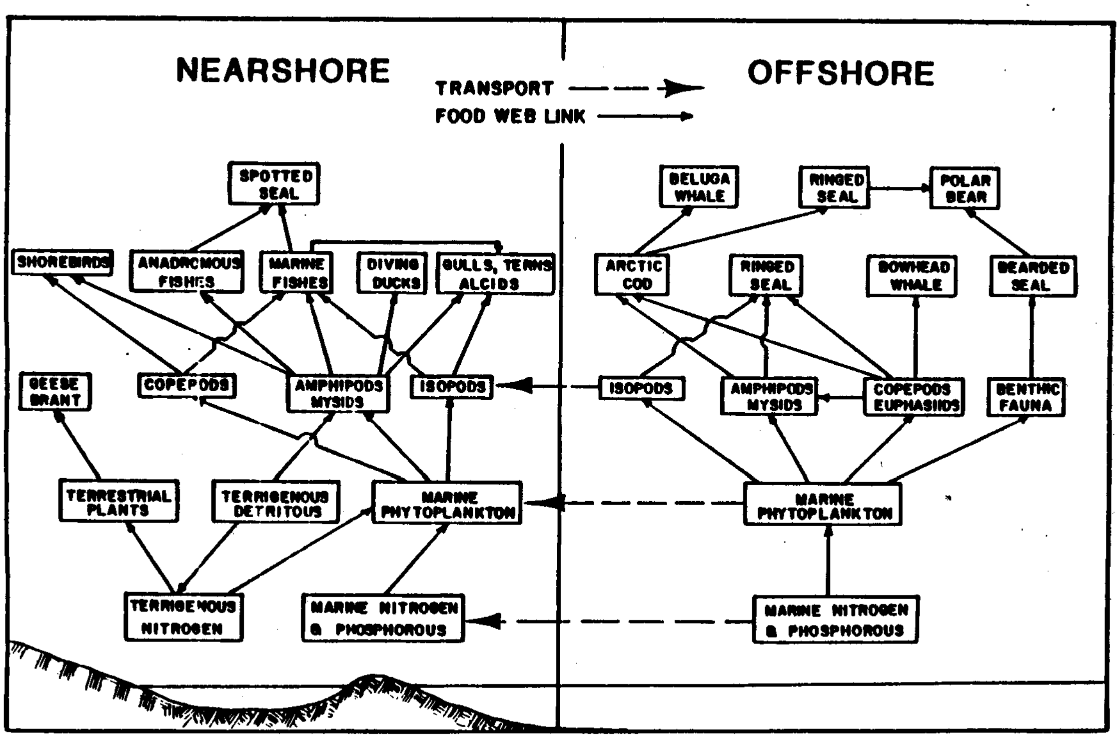


FIGURE 2 Generalized Food Web of the Alaskan Beaufort Sea
Source: Truett 1984b, p. 184



INDEX

ACRONYM

GLOSSARY

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AALRS	Alaska Automated Land Records System
ABSORB	Alaska Beaufort Sea Oilspill Response Body
ACMA	Alaska Coastal Management Act
ACMP	Alaska Coastal Management Program
ACORP	Alaska Cooperative Oilspill Response Planning Committee
ADF&G	Alaska Department of Fish and Game
AEIDC	Arctic Environmental Information and Data Center
AEWC	Alaska Eskimo Whaling Commission
AGDS	Alaska Geographic Differential Study
AMSA	Area Meriting Special Attention
ANCSA	Alaska Native Claims Settlement Act
ANGTS	Alaska Natural Gas Transportation System
ANILCA	Alaska National Interest Lands Conservation Act
ANWR	Arctic National Wildlife Refuge
AOGA	Alaska Oil and Gas Association
APD	Application for Permit to Drill
APFRT	Arctic Peregrine Falcon Recovery Team
APLA	Artificial Production and Loading Atoll
AS	Alaska statute
ASNA	Arctic Slope Native Association
ASPM	Arctic Single Point Mooring
ASRC	Arctic Slope Regional Corporation
ASTM	American Society for Testing Materials
AVCP	Association of Village Council Presidents
BAST	best available and safest technology
bbls	barrels
Bbbls	billion barrels
Bcf	billion cubic feet
BEM	Branch of Environmental Modeling (MMS, Reston, Virginia)
BF	Beaufort / Joint Federal/State Beaufort Sea Oil and Gas Lease Sale
BIA	Bureau of Indian Affairs
BIOS	Baffin Island Oil Spill Project
BLM	Bureau of Land Management
BOP	blowout preventor
BTF	Biological Task Force
CAH	Central Arctic herd
Call	Call for Information and Nominations
CASPPR	Canadian Arctic Shipping Pollution Prevention Regulations
CDU	Conical Drilling Unit
CETA	Comprehensive Employment and Training Act
CEQ	Council on Environmental Quality
CIDS	Concrete Island Drilling System
CIP	Capital Improvements Program (North Slope Borough)
cf	cubic feet
CFR	Code of Federal Regulations
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter

*Glossary includes several common abbreviations.

cm/s	centimeters per second
CMP	Coastal Management Program
COE	Corps of Engineers (U.S. Army)
CPA	Cost Participation Area
CPC	Coastal Policy Council (State of Alaska)
CPI	Consumer Price Index
CRSA	Coastal Resource Service Area
CSLC	California State Lands Commission
CZM	coastal zone management
CZMA	Coastal Zone Management Act
DEC	Department of Environmental Conservation (State of Alaska)
DEIS	draft environmental impact statement
DGC	Division of Governmental Coordination
DNR	Department of Natural Resources (State of Alaska)
DOC	Department of Commerce (U.S.)
DOD	Department of Defense (U.S.)
DOE	Department of Energy (U.S.)
DOI	Department of the Interior (U.S.)
DOJ	Department of Justice (U.S.)
DOT	Department of Transportation (U.S.)
DOTPF	Department of Transportation and Public Facilities (State of Alaska)
DST	deep-stratigraphic test
DWT	deadweight tonnage
EA	Environmental Assessment
EIS	environmental impact statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESP	Environmental Studies Program
EWC	Eskimo Whaling Commission
FAA	Federal Aviation Administration
FEIS	final environmental impact statement
FERC	Federal Energy Regulatory Commission
FR	Federal Register
ft	foot
FWS	Fish and Wildlife Service (U.S.)
FY	fiscal year
g c/m^2-yr	grams carbon per meter squared per year
ha	hectare
HUD	Department of Housing and Urban Development
ICAS	Inupiat Community of the Arctic Slope
IPP	Intergovernmental Planning Program
IRA	Indian Reorganization Act
ITL	Information to Lessees
ITM	Information Transfer Meeting
ITU	Integrated Terrain Units
IUM	Information Update Meeting
IWC	International Whaling Commission
kg	kilogram
km	kilometer
km^2	square kilometer
kW	kilowatt
lbs	pounds
LNG	liquefied natural gas

m	meter
m^2	square meter
m^3	cubic meter
M	thousand
MAC	Mobile Arctic Caisson
Mbbls	thousand barrels
MBD	thousand barrels per day
MCE	mean-case estimate
MCF	million cubic feet
mi	mile
mm	millimeter
MM	million
MMbbls	million barrels
MMcf	million cubic feet
MMcfd	million cubic feet per day
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MOU	Memorandum of Understanding
m/s	meters per second
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act
NGPA	Natural Gas Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOS	Notice of Sale
NPDES	National Pollution Discharge Elimination System
NPFMC	North Pacific Fisheries Management Council
NPR-A	National Petroleum Reserve-Alaska
NRC	National Research Council
NSB	North Slope Borough
NSBC	North Slope Borough Code of Ordinances
NTL	Notice to Lessees
NWAFC	Northwest and Alaska Fisheries Center
OCS	outer continental shelf
OCSEAP	Outer Continental Shelf Environmental Assessment Program
OCSLA	Outer Continental Shelf Lands Act of 1953
OPEC	Organization of Petroleum Exporting Countries
OSC	on-scene coordinator
OSRA	oil-spill-risk analysis
OY	optimum yield
PBU	Prudhoe Bay Unit
PCH	Porcupine caribou herd
PI	principal investigatory
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
RD	Regional Director / Resource Unit
RDA	Rural Development Assistance
REAA	Regional Education Attendance Area
RRT	Regional Response Team
RS	Regional Supervisor

RSOFO	Regional Supervisor, Offshore Field Operations
RTWG	Regional Technical Working Group
RU	Research Unit
Sag River	Saganvanirktok River
SESP	Socioeconomic Studies Program
SHPO	State Historical Preservation Office/Officer
SID	Secretarial Issue Document
SMA	spring migration area
SOA	State of Alaska
SSDC	Single Steel Drilling Caisson
stat	statute
TAP	Trans-Alaska Pipeline
TAPS	Trans-Alaska Pipeline System
TCF	trillion cubic feet
TLH	Teshekpuk Lake herd
TMP	transportation management plan
Tuk	Tuktoyatuk, Northwest Territories
USCG	United States Coast Guard
USDOI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
VLCC	very large crude carrier
VOC	volatile organic compound
WAH	Western Arctic herd
WSF	water-soluble fraction